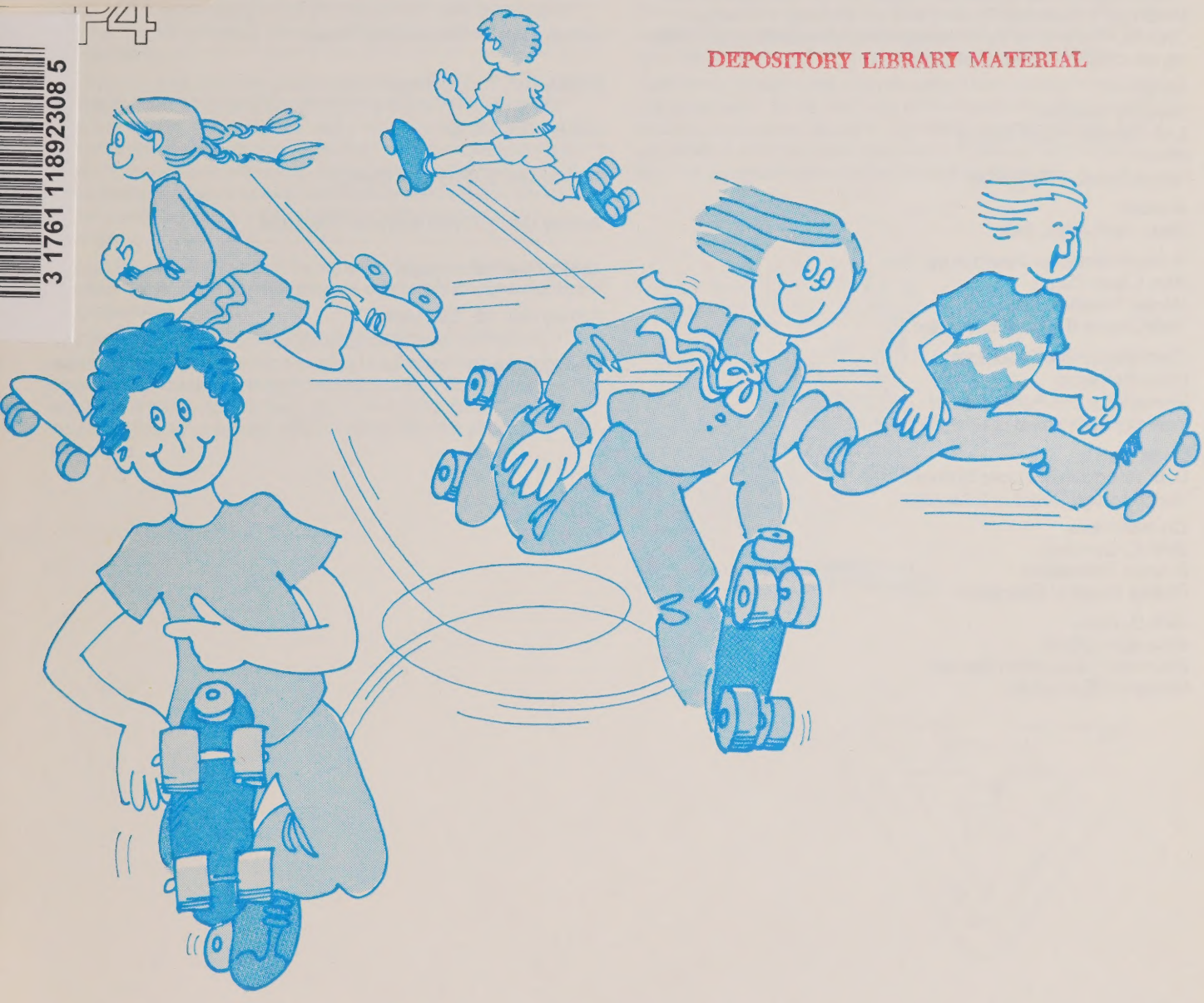
Ministry of Education
Ontario

Hon. Bette Stephenson, M.D., Minister
Dr. H. K. Fisher, Deputy Minister

Curriculum Ideas for Teachers 1980

This support document to *The Formative Years*, one of a series dealing with the conservation of energy, provides information, student material, and suggestions to teachers for presenting this topic in the Primary Division.

Transportation and Energy



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Energy One Hundred Years Ago (P7)
Where Does Energy Come From? (P8)

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Introduction

In a consideration of energy in our society, transportation must be given major importance. Statistics regarding its demand on the total amounts of energy available and consumed are included in the background information for individual activities.

Young children take the transportation of people and goods for granted. The purpose of this unit is to develop in students an awareness of a variety of transportation modes – both past and present – and to relate these to sources of energy. Transportation systems are introduced to make the children aware of the complexities of systems and the interdependence that exists among them. An attempt to look at the environmental and social impact of different transportation modes has also been made. As well, the theme deals with the concepts of efficiency and conservation.

We live in a time of rising prices, dwindling resources, environmental threats, and changes in attitudes and behaviours, as well as in technology. We can make no accurate predictions of what the effects of these changes will be on our lifestyle. However, an increased awareness of the present situation and an opportunity to speculate about the future will increase the ability of our young people to deal effectively with problems and changes.

The activity sets have been designed to be used by teachers of Grades 1 to 3. Each can be adapted or altered to suit a particular grade level or group.

The activities move from the development of the children's awareness of transportation modes to an examination of the sources and uses of energy in transportation. Some overlap exists, and some activity sets, such as Activity Sets 7 and 11, could be altered or left out without disturbing the concept sequence.

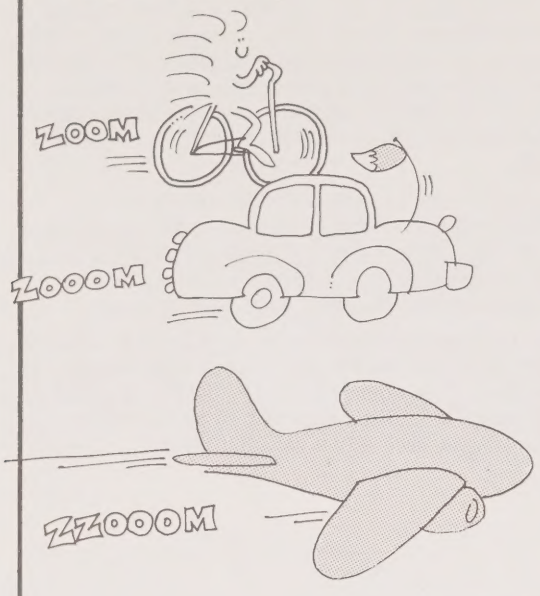
By the end of the Primary Division, the student should be able to identify the major transportation modes used in our society and their corresponding energy sources. With the aid of this document and other related resources, the student should be able to describe the uses of these transportation modes and to explain how they are depleting available energy sources (i.e., fossil fuels). Ideally, the student will be able to understand and appreciate the efforts being made to develop efficient systems that minimize waste.

In order to achieve these objectives, many of the activities should be presented more than once as the student progresses through the Primary Division. Some may be presented in their original form. However, maximum benefit will be derived by altering the approach with second or third presentations.

Test items for purposes of evaluation have not been included in this document. Some teachers at the Grade 3 level may wish to develop such items based on identification, description, and exploration criteria. Class discussion following each activity may be the best evaluation technique at this level.

Name:

Go, Go, Go



Preferred Vehicles

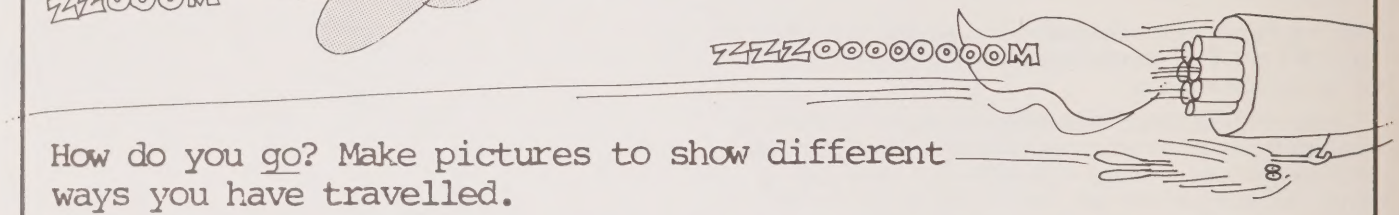
A bicycle's fine for a little trip
Up the street or down;

An automobile's for a longer trip
Off to another town;

An airplane's fine for around the world,
To many a far out place;

And a rocket, oh, for the longest trip
Away into outer space.

Source: Leland B. Jacobs and Marjorie Lawrence, Beginning Book of Poems (New York: Addison-Wesley, 1976), p. 10.



How do you go? Make pictures to show different ways you have travelled.

On the back of this page, make pictures of ways you would like to travel.

Notes

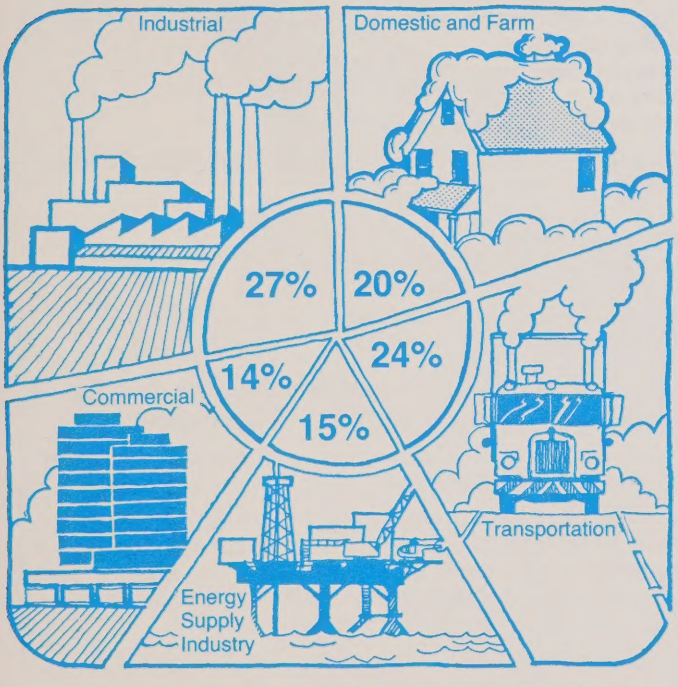
The objectives of this activity set are:

- to define the term "transportation";
- to identify types of transportation; and
- to sort these types according to a variety of criteria, most notably people versus goods.

Transportation, the movement of goods and people, is a familiar aspect of daily life for all children. The purpose of this activity set is to examine modes and patterns of transportation in our society and the relationships that exist among them. By investigating the systems involved, students will gain an appreciation for the complexity and interdependence of the systems that exist in our society.

The main focus of the topic is on the energy involved in transportation. Although the figures on percentage use will be of little importance to children in Primary classes, you can begin to implant in them an awareness of our society's dependence for transportation on oil (the primary energy source involved), emphasizing that it is a limited and non-renewable resource. It is to be hoped that, when these children become adults, they will recognize the need for efficiency and conservation in transportation systems.

Figure P4.1: Total Energy Use



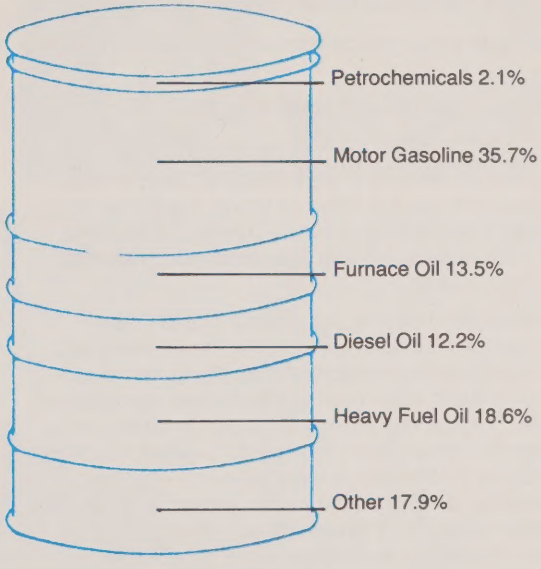
Source: Energy, Mines and Resources Canada, *The Car Mileage Book* (Ottawa: Publishing Centre, Supply and Services Canada, 1977), p. 80. Reprinted by permission of the Minister of Supply and Services Canada.

Over 42% of liquid petroleum products are used for transportation. The largest consumers are automobiles (53.4% of total transportation use) followed by trucks (22.0%). Thus road transport accounts for approximately 75% of the total energy demand in the transportation sector.

Source: Energy, Mines and Resources Canada, *Energy Conservation in Canada: Program Perspectives*, Report EP77-7 (Ottawa: Publishing Centre, Supply and Services Canada, 1977), p. 24. Reprinted by permission of the Minister of Supply and Services Canada.

The approximate percentage of petroleum products used for transportation can be seen in Figure P4.2 by combining the motor-gasoline and diesel-oil figures.

Figure P4.2: Average Canadian Yield From a Barrel of Petroleum



Data is for 1976.

Source: Energy, Mines and Resources Canada, *Energy Update* (Ottawa: Publishing Centre, Supply and Services Canada, 1977), p. 26. Reprinted by permission of The Minister of Supply and Services Canada.

In the activity set, the children are encouraged, through the use of the poem, to look at modes of transportation as they relate to different situations. They are then asked to consider all the ways they have travelled and would like to travel. The student activity sheet may be duplicated and used either by individual students or as a basis for group discussion.

Follow-up Activities

1. After the children have completed the suggested activity, a co-operative wall chart showing "Ways We Have Travelled" should be developed and retained for further reference as the unit progresses.

2. The chart developed in the previous activity can serve as the basis for a classification activity. For non-readers, simple cards depicting each method of transportation can be made. Modes of transportation can be classified as follows:

– those that carry goods versus those that carry people;

– those that transport large groups versus those that transport small groups;

– wheeled vehicles versus non-wheeled vehicles;

– land, air, and water vehicles.

The classifying can be done as a large-group activity, in which the various modes of travel are listed by you or the students on large chart paper. It may also be done by having the students physically sort word or picture cards independently or in small groups at a learning centre.

3. Since the poem mentions a rocket and our students are space-age children, a simulation game would be an excellent opportunity for individual expression and creativity. For example, in the gym or a large, open space, the children can pretend to be astronauts. They can do this in mime, concentrating on body awareness and sensations. You should suggest situations for them to act out (e.g., blast-off, weightlessness, changing fuel, eating, sleeping, landing on the moon, exploring [different gravity], and return to earth). If this exercise is videotaped, the children can view the replay and discuss their roles and how they felt.

Related Ideas

1. Have students do classification and sorting activities using the co-operatively developed wall chart "Ways We Have Travelled". They should establish the sorting rule for each activity. They should also come to see that an element from the chart could be classified as a member of more than one set or classification.
2. Set up a reading corner that contains fiction, non-fiction, and poetry books on transportation and energy for use during the unit.

3. Transportation poems are plentiful and they can be used in a number of ways. The following are two poems that are particularly appealing:

Train Ride
Chugging-tugging,
chugging-tugging,
roaring down the track.
Tugging-chugging,
tugging-chugging,
when you coming back?
Creaking-screeching,
creaking-screeching,
who put on the brakes?
Screeching-creaking,
screeching-creaking,
noises that it makes.
Whooshing-swooshing,
whooshing-swooshing,
charging through the night.
Swooshing-whooshing,
swooshing-whooshing,
soon be there all right.
Tug and chug, chug and tug,
train begins to slow.
Creak and screech, screech and creak,
people that you know.
Whoosh and swoosh, swoosh and whoosh,
pulling into station.
Slam and hiss, then
silence –
Reached your destination.

Source: Mrs. Laurie Ayres, Teacher, Baythorn Public School, Willowdale. Printed by permission.

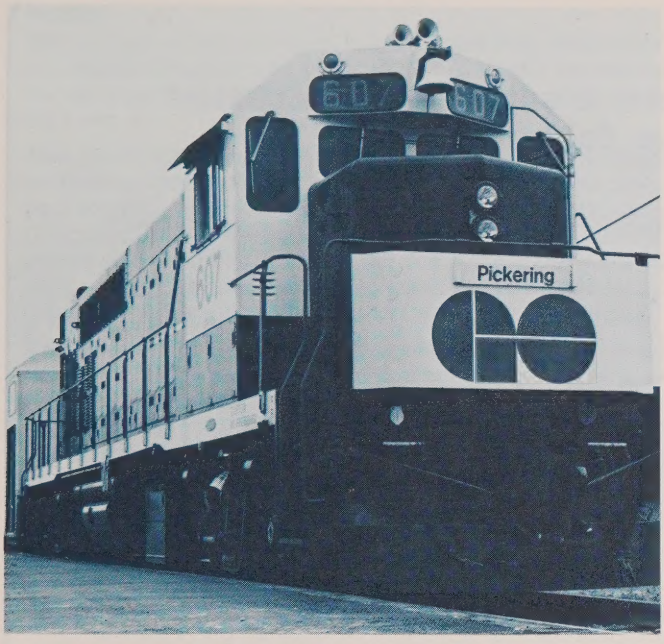
Homemade Boat
This boat that we just built is just fine –
And don't try to tell us it's not.
The sides and the back are divine –
It's the bottom I guess we forgot...

Source: Shel Silverstein, *Where the Sidewalk Ends* (Toronto: Fitzhenry & Whiteside, 1974), p. 12. Reprinted by permission.

4. Use transportation words as a basis for spelling, phonics, or other language-skills lessons.

5. Prepare large cutout shapes (e.g., airplane, bus, truck, ship). Have students cut and paste on magazine pictures that they associate with each shape (e.g., the truck shape might include pictures of goods carried). Allow time for group discussion and questions regarding the associations.

6. Mount poems that deal with transportation on task cards and place them at the painting centre. Have the children paint pictures to accompany each. (Old readers that can be cut up provide a handy, ready-made source of poems.)


607
Pickering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GO TRAIN
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AND SONS LTD
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TORONTO


AIR CANADA

Name:

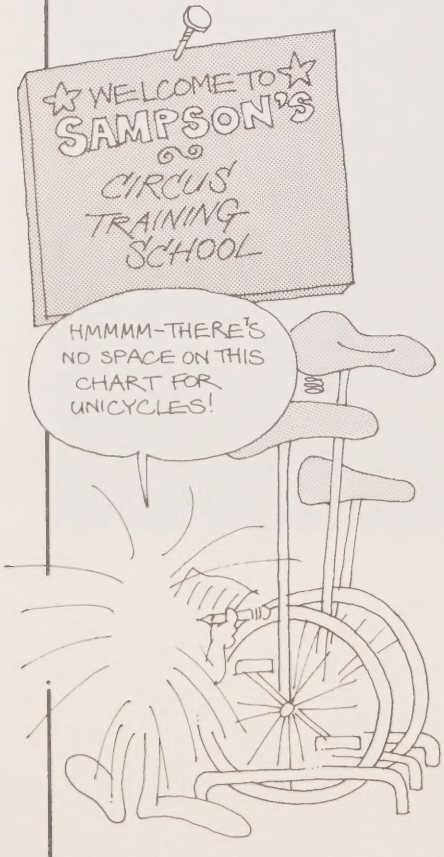
8

Let's Count Vehicles

Go to the school parking lot and make a survey of the parked vehicles. Tally your findings in the following chart:

	Cars		Bicycles	Trucks	Buses
	Small	Large			
Total					

Find out how many buses come to your school each day and enter the number in the chart.



Draw a picture.

How I come to school	How my teacher comes to school

Use the back of this sheet to show all the ways that your family travels.

Notes

The purpose of this activity set is to have students collect data and organize them in a simple chart, and to identify the sources of energy associated with walking, riding a bicycle, and operating a car.

After identifying types of transportation, the children should concentrate on those with which they are most familiar. The concept of energy as the means of doing work (e.g., moving an object from one place to another) should be introduced. Since energy used for transportation makes up almost one-quarter of all the energy we consume, transportation has a significant impact on both the present and future consumption of energy.

According to *The Car Mileage Book*, the privately owned automobile in Canada accounts for 15% of our total energy budget and 25% of all our petroleum. Cars are the largest single consumers of energy in this country. Over half of the energy used for transportation is consumed by private cars. In a time when energy conservation is essential, the wise and efficient use of the private car is a major concern for all of us. Today's students must have sufficient information to make energy-conscious decisions as they move into decision-making roles regarding the transportation of people. Economic and environmental factors will alter attitudes towards public and private transportation in the next ten to fifteen years.

In the 1950s and 1960s, use of the private car grew because of its comfort, convenience, and relatively low operating costs. The use of public transportation became equated with the inability to afford a car. Several factors in the 1970s played a major role in altering this attitude, but it would appear that we still have a long way to go in making public transportation a viable and acceptable means of commuting.

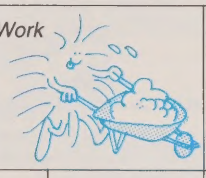
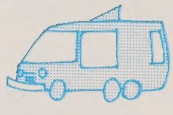
Before beginning the parking-lot survey, introduce the children to the tally method of recording their counts. Discuss the types of vehicles they expect to encounter and agree upon some definite criteria for what constitutes a "big car" as opposed to a "small car" (length, number of cylinders, weight). You will have to expect that there will still be individual differences in judgement. After the survey is completed, have the children do their computations independently. Encourage discussion among the children about the energy source of each type of vehicle. Accept "gasoline" or "engine" as the source of energy, and provide more accurate terminology as the need arises during the development of the theme.

Follow-up Activities

1. Have the children conduct a home survey, listing all the items there that are used to transport goods or people. Have them identify the energy source of each item. The individual lists can be used to prepare a class profile. An interesting comparison might be made by exchanging the class profile with that of a school in a different socio-economic area. If this is done, encourage the children to discuss the differences they find and suggest reasons for these differences.

2. Use the data gathered in the home survey and have the children classify the items in a chart using pictures or words according to whether the items are used for leisure or work.

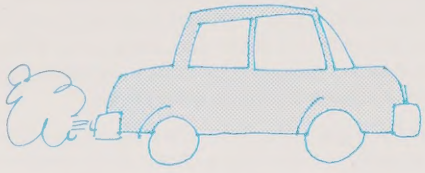
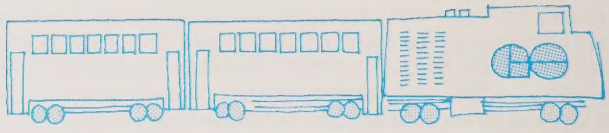
Table P4.1: Leisure/Work

Play 		*Work* 		*Both* 	
Item	Energy Source	Item	Energy Source	Item	Energy Source

3. With your class, survey the public transportation systems available in your community. Have the students contact the local authorities about present services, proposed expansion, and statistics on public use. A hypothetical situation like the one that follows (based on approximate figures for travelling from Oakville to Toronto) can be used if relevant data are unavailable in your community.

Table P4.2: Cost of Getting to Work

(Typical example: one way = 40 km)

Type of Transportation				
	(1) Private Car (compact):		(2) Diesel Commuter Train: GO system	
Costs	Gasoline (one-way – $.90):	_____	Fare (one way – $1.70):	_____
	Parking:	$3.50	Travel to GO station (return):	_____
	Other (insurance, maintenance, and depreciation):	.50	Other connecting travel:	_____
	Daily Total:	_____	Daily Total:	_____
	Monthly Total:	_____	Monthly Total:	_____
Time	One way – 60 min.		One way – 37 min.	
Fuel	Gasoline		Diesel	
Special Rates	None		For commuters: a) 1 week (10 trips) – $14.75 b) Monthly pass – $51.00	_____ _____
Cost per person		_____		_____
	How can this cost per person be reduced?			

The children can use this chart to do arithmetic calculations (e.g., comparing costs and working out average costs per person), and to practise decision-making by discussing the wise use of energy resources for transporting people.

Related Ideas

1. The children can survey the vehicles passing the school during 15 min periods at various times during the day (e.g., at 9:00, 10:30, 12:00, and 14:30). Discuss with them any patterns that emerge (e.g., busy times, the use of delivery trucks and buses).

2. Have your students investigate mass-transit systems in other countries. (This activity can be incorporated with a social studies unit.)

3. Have the children design a model of a mass-transportation system of the future. This can provide the beginning for a study of a community of the future.

Name:

Across the Schoolyard

Method	Number of "Steps" or "Pushes"	Time	How I Felt
			
			
	allow coasting		
	allow coasting		
	allow coasting		
	allow coasting		

Do you think the surface makes a difference?

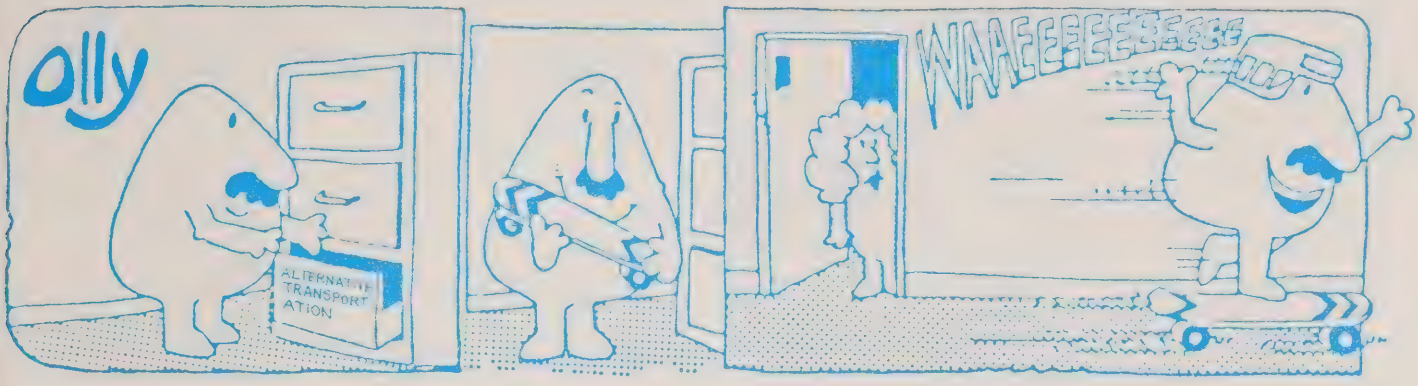
Try a similar distance on another surface (paved parking lot or sidewalk).

Make a chart for the new surface on the back of this sheet.

Notes

The purpose of this activity set is to determine the efficiency of converting one form of energy to another, and to identify friction as a force that retards the motion of objects.

Figure P4.3: Alternative Transportation



Source: Reprinted by permission of Shell International Petroleum Company, London, England.

By using tricycles, bicycles, and other "transport toys", two rather difficult concepts – those of conversion and friction – can be introduced. It should not be expected that the children will fully understand these concepts, and complex explanations should be avoided at this level. If the children think of the food energy used to move the bike or trike as the primary energy, and the energy used in the movement from start to finish in the suggested activity as the secondary energy, then they will begin to appreciate the "energy problem".

> Primary energy is the quantity of energy as it is produced in the form of crude oil, natural gas, etc., regardless of its use. [In this activity it is food eaten by students.] Secondary energy is the energy as it is received by the consumer. [In this activity, it is the energy content of the food that goes into the motion of the trike or bike, etc.] An example of the relationship that exists in using fossil fuels is that roughly three units of primary energy are needed to generate one unit of secondary energy in the form of electricity.

Source: Adapted from National Energy Board, *Canadian Oil: Supply and Requirements* (Ottawa: National Energy Board, February 1977), p. 32. Reprinted by permission of the Minister of Supply and Services Canada.

Have the children work in pairs to complete the chart for the suggested activity. They will require instruction about safety precautions and perhaps a letter from home allowing them to use the various "vehicles" suggested for the experiment. Select a distance about the length of a football field for the experiment, so that significant differences in (a) the number of steps or thrusts, (b) time, (c) feelings will result from the tests depicted in Activity Set 3. The class can be grouped so that each pair of students is not required to evaluate all the suggested methods of travel.

In the discussion that follows the experiment, the children should realize the limits of human energy as a source for motion and reach some conclusions regarding the factors that increased the potential of human energy to transport them from the start to the finish. Talk about how "puffed out" they feel and discuss food as the energy source that allows them to go.

If the activity is carried out on a grassed area, some children will mention this as a hindrance, particularly with the skateboards. This observation will lead nicely into the follow-up suggestion on the activity sheet and into a discussion of friction.

Follow-up Activities

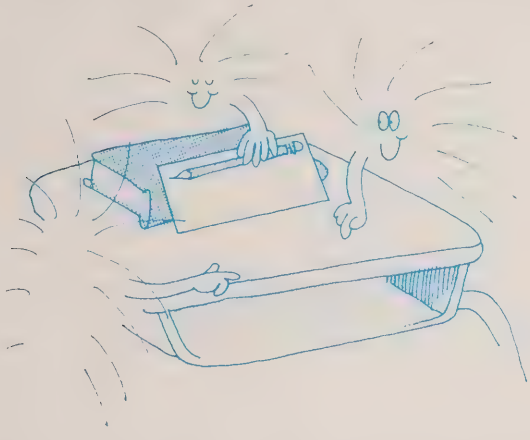
1. The concept of friction as a force that retards motion is one that the children will have experienced in many forms, but probably not yet articulated. A simple investigation can be carried out. Divide the class into small groups. Provide each group with a piece of cardboard (about 20 cm square) and a variety of materials for test purposes. These might include waxed paper, a kitchen towel, a rug sample, sandpaper, corrugated paper, wool material, and floor tile. Each group should have a chart on which to record the data they collect. The following is a sample:

Table P4.3: Surface Friction

		Distance	
Surface	Guess	1st roll	2nd roll
Desk top			
Waxed paper			
Kitchen towel			
Rug sample			
Sandpaper			
Corrugated paper			
Wool fabric			
Floor tile			

Demonstrate the following procedure for the children:
a) Make a ramp by propping up one end of the cardboard with a book, 5 cm to 6 cm high.
b) Place a pencil at the top. Before allowing it to roll down the ramp, guess how far it will roll. Then let it roll down the ramp.
c) Measure the distance, in centimetres, that the pencil rolled across the desk.
d) Repeat the procedure to see if the same results occur.

Now have the groups of students do this experiment using the different materials to cover the desk. Their results should be entered on their charts.



When discussing the results of this experiment, identify friction as the force that slows the motion. Have the children suggest the source of friction that affects a moving automobile. Ask them how it is reduced. When is friction a good thing? (on icy roads)

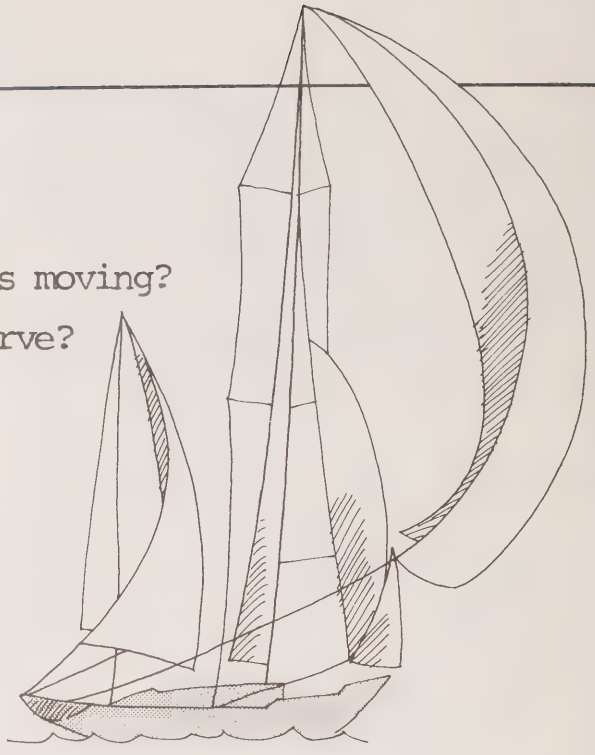
2. This activity deals with the effect of tire pressure on the movement of bicycles. It is most suitable for work with children in Grade 3. Select two of the students' bicycles for this demonstration. Make sure they are of similar type and that the students are of similar size. Inflate one bicycle's tires to normal pressure and those of the other bicycle to half that amount. Ask the students to ride them side by side at the same rate of speed for a marked distance, and then to coast. Compare how far each coasts. Discuss the difference (a) in distance coasted, (b) in effort required. Allow other children to pedal each bicycle. Do they notice differences when pedalling each bicycle? Encourage the children to see that proper tire inflation is an energy-conservation practice. Relate this idea to the private car. A possible extension would be to have the students ask their parents to check the tire pressure of their car and compare it with that recommended in the owner's manual. The children can share their findings with the class.

3. The children should be made aware of bicycle safety through the "Go Safely Cycler's Course". This is an excellent program developed by the Ministry of Transportation and Communications, Ontario. It includes attractive and illustrative support material, which can be obtained free for the purpose of teaching children safe cycling. An instructor's manual, containing step-by-step instructions, is included. An interested parents' group might take on the project of instructing the children. Further details can be obtained by writing:

Safety Office
Ministry of Transportation
and Communications
Ferguson Block
Queen's Park
Toronto, Ontario
M7A 1Z8

Name:

What Makes It Go?



To Think About

How can you tell that this boat is moving?

What makes the sail billow and curve?

Which way is the boat moving?

What makes each of the following boats move?

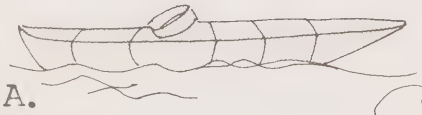
A. _____

B. _____

C. _____

D. _____

A.



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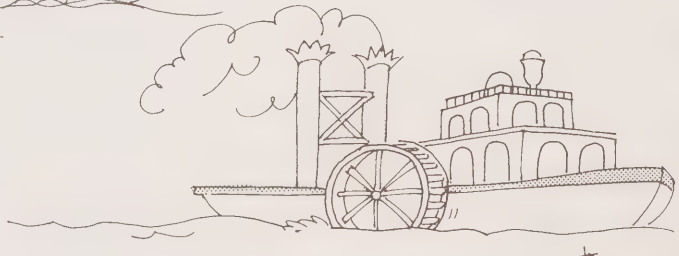
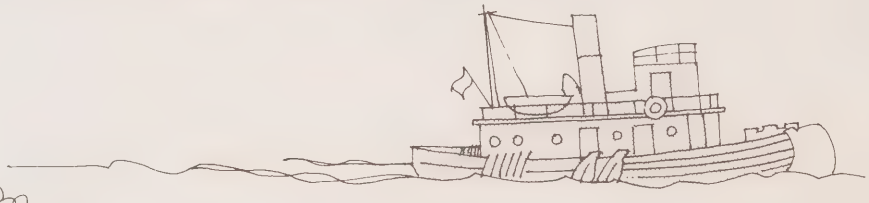
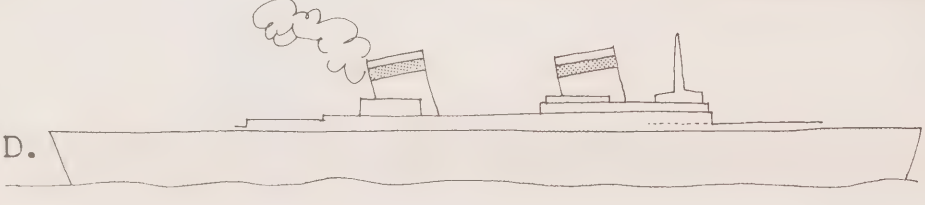


C.



D.



Choose one of the five boats to find out more about. Write your report on the back of this sheet.

Notes

The purpose of this activity set is to identify sources of energy used in marine transportation and to examine the history of marine transportation.

Although the energy demands made by marine transportation represent only a small percentage of the total energy demand for transportation, boats are fascinating for children and of particular importance in Ontario with its extensive inland waterways.

Energy to power boats has, in the past, come from a variety of sources. However, petroleum has been, and will, in the foreseeable future, continue to be of prime importance. Marine transportation will be referred to again later in this unit as part of the system required to deliver oil from its source to the places it is used. Also relevant to the whole energy picture are the environmental problems associated with shipping: in particular, the dangers posed by large oil tankers off the coast of Alaska and British Columbia.

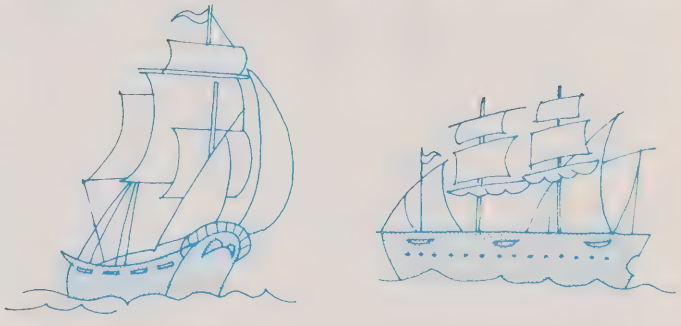
The children may have difficulty visualizing the motion of the boat being moved by the wind in the illustration on the activity sheet. A model at a water centre or on a nearby pond or creek would be ideal to demonstrate this movement. In this case, the children should be encouraged to build their own sailboats and to discuss the relative success of the designs.

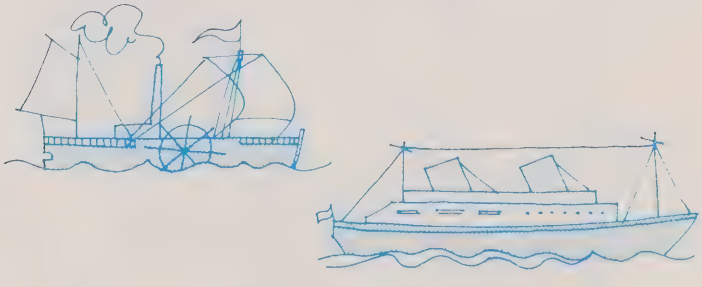
The main focus of the other examples on the activity sheet should be that energy is required to do work, that is, to move the boats. At this point, it might be wise to point out that large ships are powered by a petroleum derivative called diesel fuel, while smaller craft are often propelled by outboard motors, which are fuelled by gasoline.

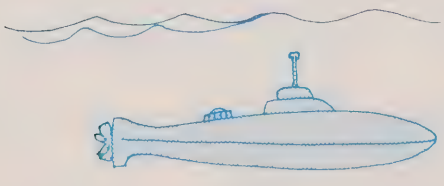
Follow-up Activities

1. After identifying the energy sources involved in the main activity, the children can refer to the lists they made in the follow-up activity to Activity Set 1, and categorize each method of transportation according to its energy source. The class can be divided into groups, with each group responsible for creating a booklet containing labelled pictures of different energy sources (e.g., wind, human energy, etc.).

2. Provide the children with pictures illustrating the stages of development in water travel. A typical sequence is included here for your convenience.





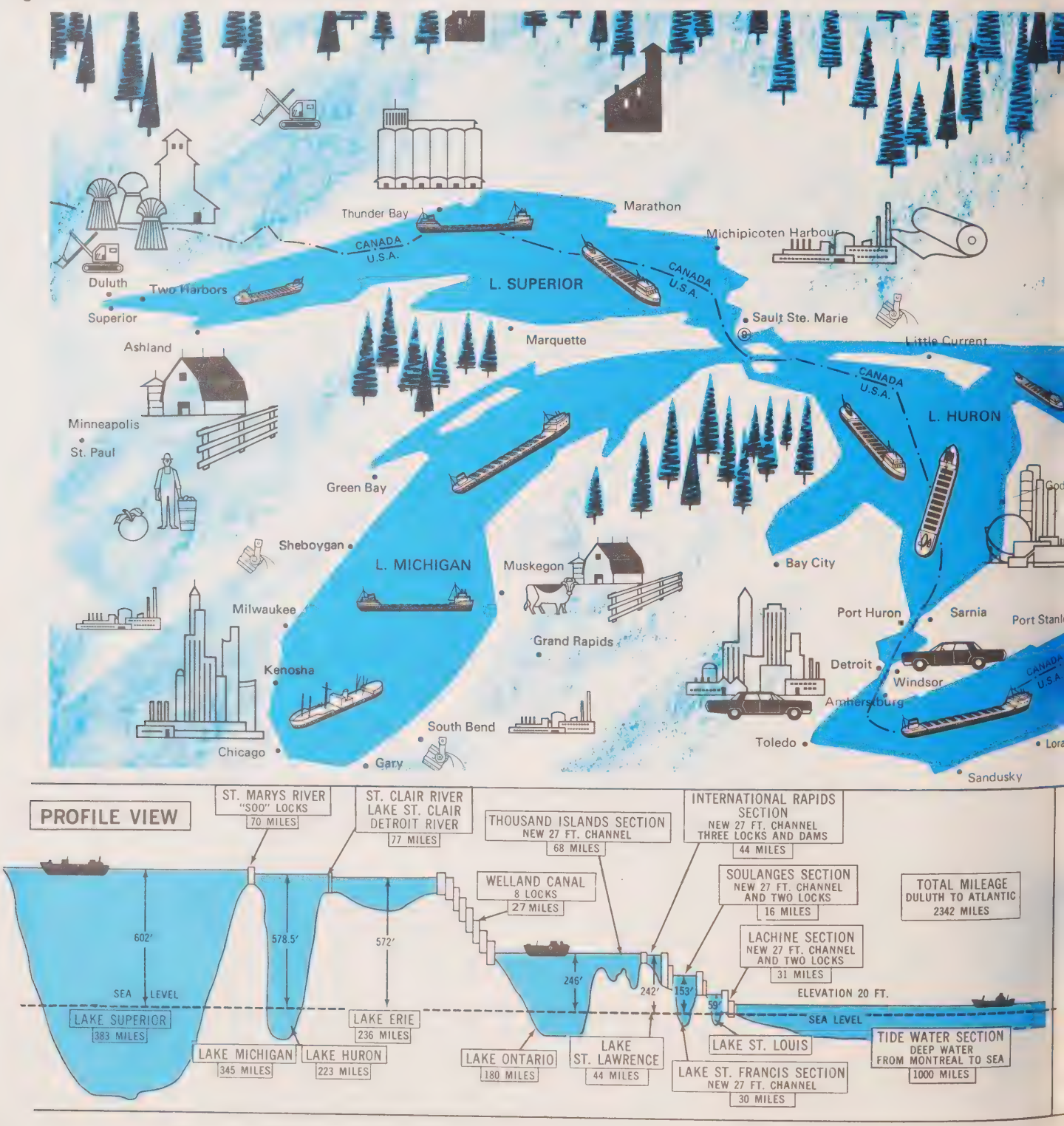


The children can arrange these in what they think to be the proper sequence. Provide additional support material so that they can check their sequences and add additional forms of water transportation. Encourage the children to include those forms of transportation peculiar to Canada (e.g., the kayak, the *umiak* of the Inuit, the birch-bark canoe of the Indian, the lakers of the St. Lawrence Seaway, and the icebreakers of the North). Have them indicate how vessels have changed in terms of speed, the distances they travel, and safety. Include a discussion of canals, and provide a map of the canal system of the St. Lawrence Seaway or make use of an appropriate set of atlases.

Have the children prepare a co-operative mural depicting the results of their investigations.

3. Have the children design a water-transportation vehicle of the future. Ask them to consider speed, safety, cost of operation, purpose, environmental impact, and the energy source required to power their creation.

Figure P4.4: St. Lawrence - Great Lakes Waterways



Related Ideas

1. Read the children the Biblical story of the Ark. The follow-up discussion could deal with the relative kinds of energy used (effort involved) in building the Ark then as compared to building it today.

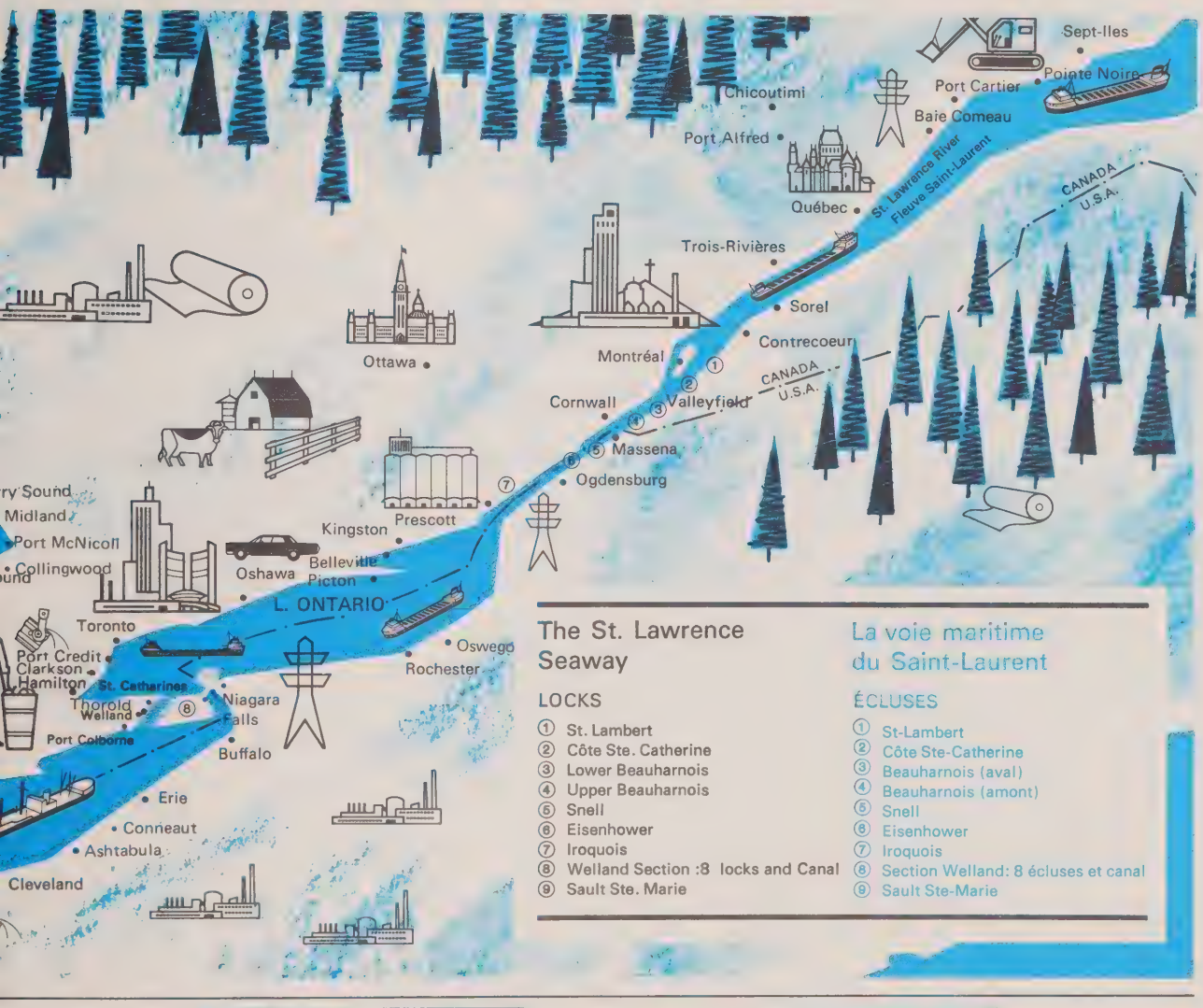
2. Have the children locate and read for interest adventure stories about boats from the library or in readers.

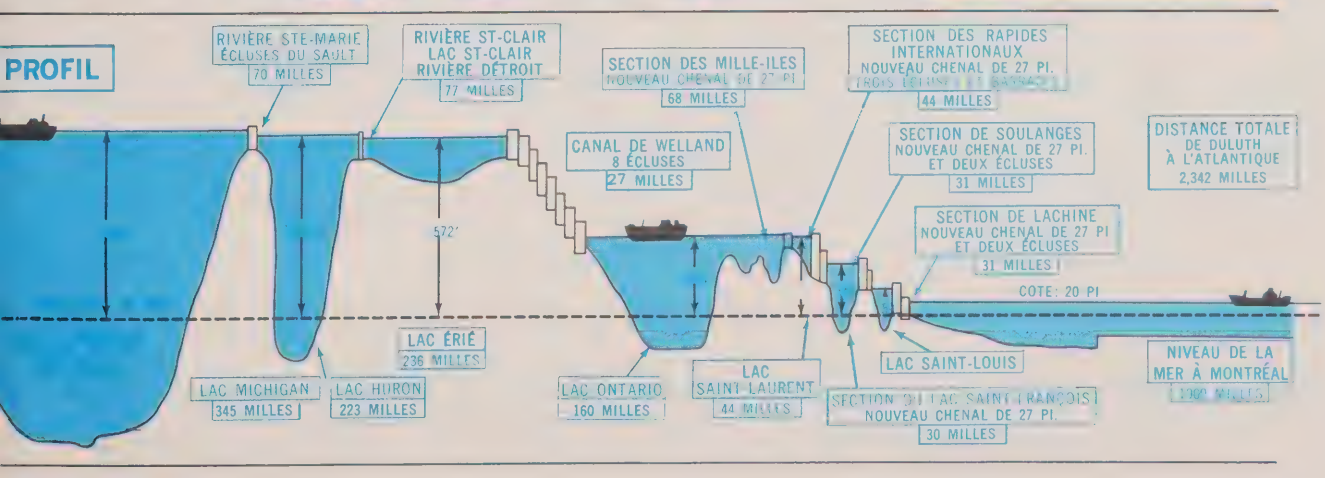
3. Have the children describe an imaginary shipwreck. They should talk about who was with them, what they were doing on the ship, where they planned to go, and how the ship was wrecked. They should also tell how they escaped and how long all of this took.

4. Show and discuss films that deal with water transport. (See the bibliography for some suggested titles.)

5. Have students use a map to draw a route they would take around the world. They should name one thing they would like to do at each stop along the way.

Source: The St. Lawrence Seaway Authority Information Office, Place de Ville, Ottawa, Ontario K1R 7R9. Reprinted by permission.

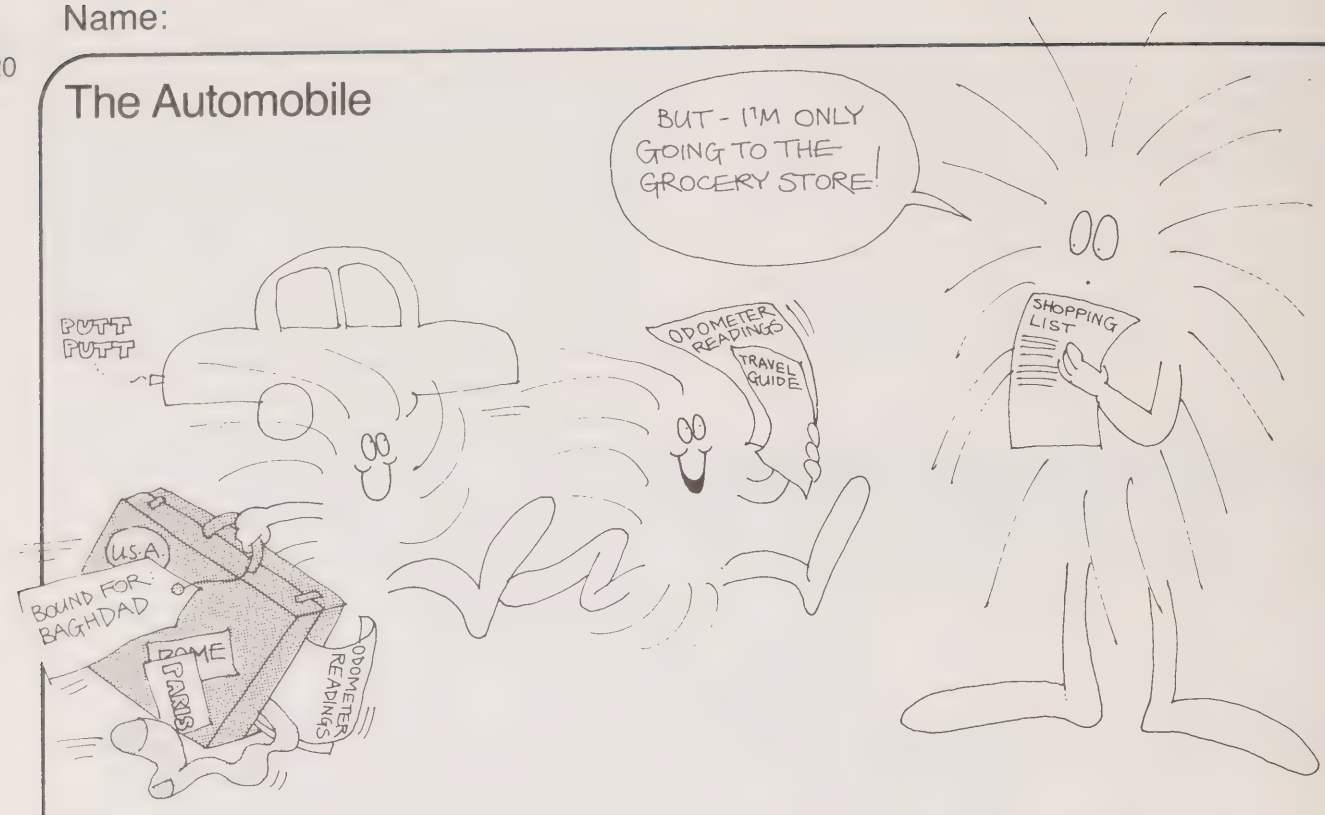




Name:

20

The Automobile



My family car or a friend's car Week of _____

Date	Odometer Reading		Where We Went	Passengers
	Start	Finish		

Draw a picture of your family car on the back of this sheet.

Notes

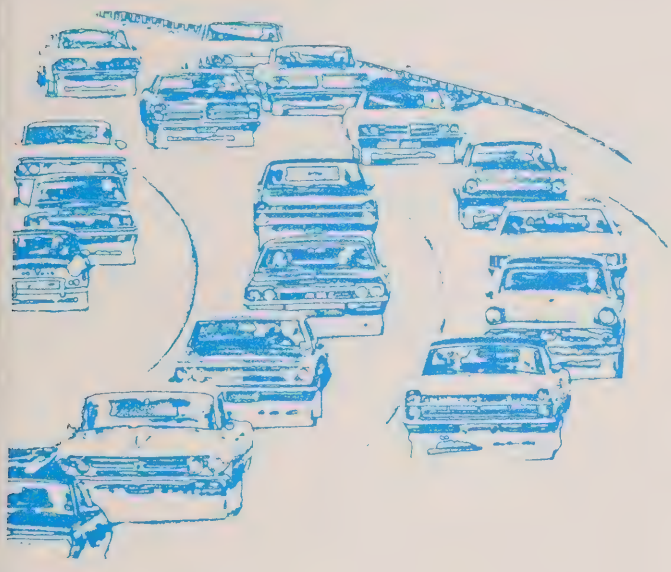
The purpose of this activity set is to examine the use of the car, to collect and record information over a period of time in chart form, and to analyse the collected data to determine trends.

In Canada we consume about 15% of our total energy budget and 40% of all our petroleum to drive our cars. Cars are the largest single consumer of petroleum in this country.

Since it also takes energy to build a car, it also makes sense that if we made our cars last longer through proper care and maintenance, we could reduce the "energy investment" needed to build new cars.

If we could reduce the amount of gasoline we use by 25% in two years, more than two billion gallons would be saved. That's enough to heat every oil-heated house in Canada for one entire winter.

Source: Minister of Energy, Mines and Resources Canada, in *The Car Mileage Book* (Ottawa: Publishing Centre, Supply and Services Canada, 1977), Introduction, p. iv. Reprinted by permission of the Minister of Supply and Services Canada.



Although elementary school children can have no direct impact on energy use or conservation related to the automobile, they can have a dramatic indirect impact. Children can stimulate family thinking about lifestyles and perhaps alter the family's present practices. They can influence decisions about their own transport – to school and other activities – and they can influence decisions about the use of public transit for family outings.

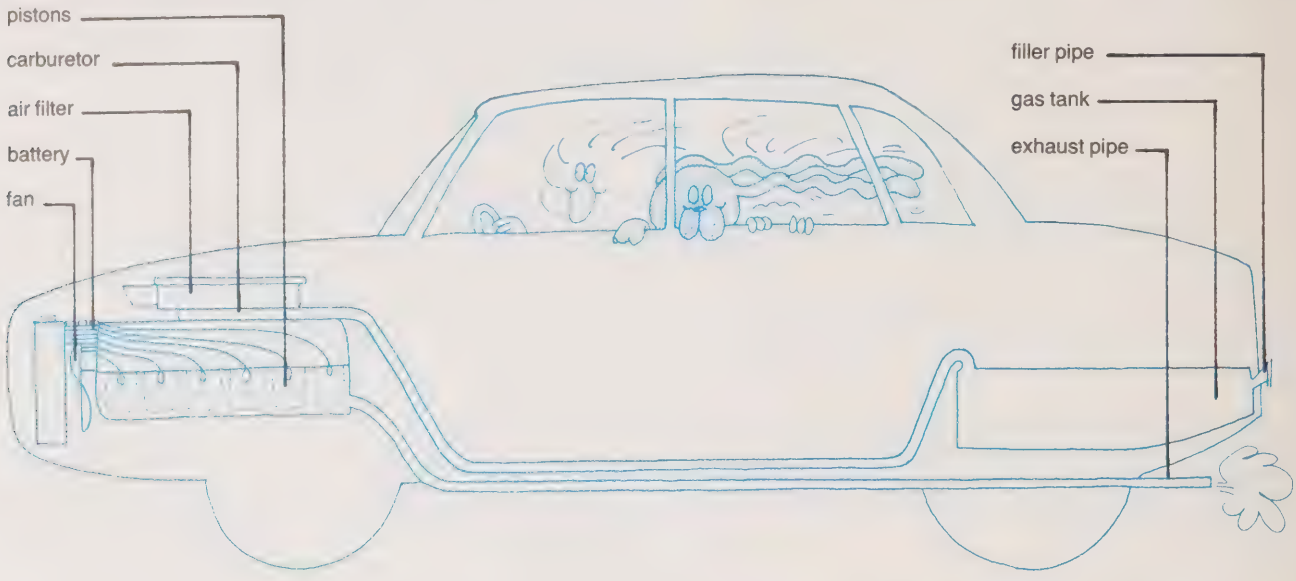
Finally, our students will soon be in a position to make decisions as direct consumers. The better informed they are and the more social conscience they possess, the more likely they are to make decisions that will enable the continuance of the "good life", and at the same time save valuable energy.

Since this activity directly involves the family, its attitudes, behaviours, and values, it is essential to enlist parental support at the outset of the activity. In a letter to the parents, briefly explain the nature of the program and the specific request to keep a log of the use of the family car or a friend's car for one week. Request permission for student participation and the use of the statistics to establish trends and patterns. During the week of statistics-gathering, other activities suggested in the follow-up activities can be carried out. Once the logs are completed and submitted, community trends and use patterns can be established and discussed.

Care should be taken not to impose value judgements or to cause embarrassment to any child if, for instance, the family does not have a car. However, the children can be asked to consider alternatives to some of their families' trips, especially if they were being driven some place (e.g., car pools for trips to Brownies, Cubs, or other groups that many of the children attend).

A follow-up letter to the parents thanking them for their co-operation and providing them with a brief summary of the findings or of interesting student statements or suggestions would be a valuable public-relations gesture. It might also heighten the awareness of the *real* consumers.

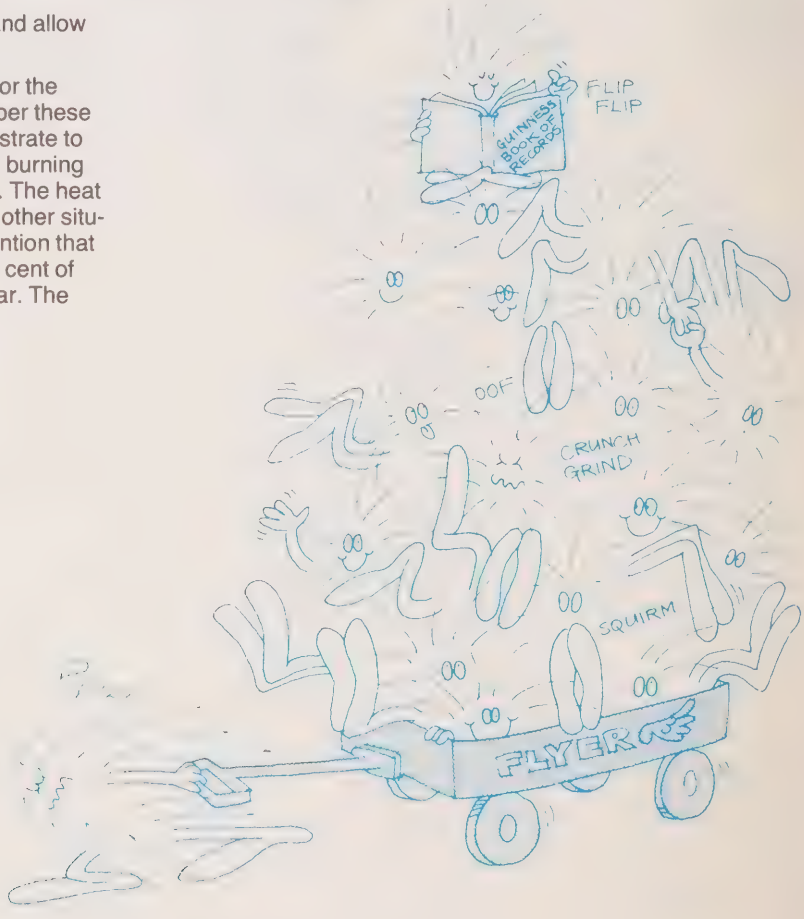
Follow-up Activities



1. Prepare for projection a large transparency (like the accompanying illustration) that shows the route of gasoline through an automobile to the engine, and the exhaust route through which the waste gases and particles escape. (Relate this activity to Activity Set 9.) Take the children to the school parking lot and locate these parts on a car. *After taking proper safety precautions*, start the engine of the car. Lift the hood and allow the children to see and hear the engine in operation.

Encourage the children to use the proper vocabulary for the parts of the system, but do not expect them to remember these words. A cloth placed over the car exhaust will demonstrate to the children the production of waste products from the burning of fuels, which they may have experienced elsewhere. The heat from the engine can be related to the heat released in other situations that involve the burning of fuels. (You might mention that even with the most efficient engines only about 25 per cent of the gasoline consumed is actually used to move the car. The balance is lost in heat and exhaust fumes.)

2. Demonstrate to the children that the amount of energy required to move a vehicle is related to the size of the vehicle. Have the children pull an empty wagon over a given distance. Increase the weight by adding children to the wagon until one person can no longer pull the load.



Apply the results of this activity to cars. Emphasize that a greater amount of energy is required to move a big, heavy car than to move a small car.

Encourage the children to have their parents send for *The Car Mileage Book* from:

Office of Energy Conservation
Energy, Mines and Resources Canada
P.O. Box 3500
Postal Station "C"
Ottawa, Ontario
K1Y 4G1

3. Have the children draw or paint the kind of car they might like to have when they are adults. Ask them to tell what its source of energy would be, how it would work, and what use they would make of it.

Related Ideas

1. Have the children set up a variety of toy racing-car sets and compare the sets in terms of speed, efficiency, and car and track construction. Have them examine the advertising for these sets. Do they really work the way the advertisers claim they will?

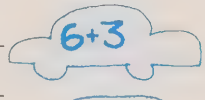
2. Show a film on the history of the automobile. Discuss with the children changes in automobile size, wheels, use, and energy sources.

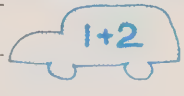
3. Make a large cardboard model of a car. Working independently, the children can match word cards with the appropriate parts of the car (e.g., tire, hood, exhaust pipe, door, window, etc.).

4. Use car shapes for drilling basic number facts. Divide a large piece of cardboard into squares to represent parking spots. Place a number in each square. Put an addition problem on each of the car cutouts. The children then "park" their cars in the correct space.

4	6	8
9	3	5
7	2	10

Car Park





Name:

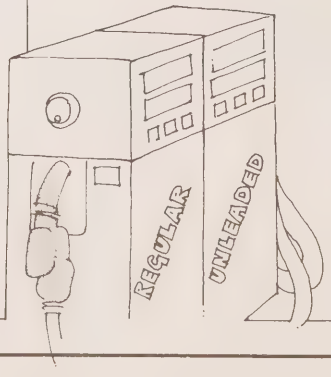
Service Station

What does the service station sell?

What things are done for customers?

Who works at the service station?

How much does the gasoline cost?



Notes

In this activity set, the children are encouraged to identify oil as the source of energy in gasoline and to find out about other petroleum products. They will also identify and describe the work done by service-station employees and explain how their jobs are related to the delivery of energy.

Since the automobile is our most energy-intensive form of transportation and one that our society has come to take for granted, a visit to a service station will provide children with an opportunity to explore more fully just what gasoline is and to gain some idea of its rate of consumption.

Use the student activity sheet to initiate a discussion of the service station. List things students know about its services and operation, and things they would like to discover. A field trip of this nature might best be handled by dividing the class into small groups and assigning each a specific task. After the trip, each of the groups can report on its findings to the whole class. Since there are potential safety problems, careful planning, proper adult supervision, and co-operative and informed service-station managers are essential. The following suggested plan will probably require one hour:

1. A brief introduction by the station manager to the whole group (10 to 15 min).

2. A group investigation of the business. Students might be divided into groups, with each group being assigned one of the following activities. (Prepare a task card for each group with specifics about the activity and a space to record observations.)

a) Find out the size and value of each gasoline sale during your visit. Record the type of vehicle in each case. In the case of cars, note whether each is large or small.

b) Interview the people working at the service station. Use a tape recorder. Find out what each person does. Ask what training is needed for the job.

c) Interview the manager. Find out where he/she buys the things that are sold. Make a list of other things he/she has to buy.

d) List the things the service station sells. Indicate which ones have oil as their source. What happens to the waste oil in the grease pit?

e) Find out where the gasoline is stored. Where does it come from? How does it get to the station?

f) Make a list of all the sounds and smells around the station. Note the source of each.

Appoint one of the students to be the photographer. A Polaroid camera is best for student work at the Primary level.

Follow-up Activities

These activities can be undertaken back at school after the visit:

1. Have the class make a large floor plan or model of the service station. As each group makes its presentation, appropriate additions to the drawing or model can be made.

2. Have students draw a map of the area where the service station is located. Have them show the route from the school to the station. They can also mark other service stations on the route. Discuss with them the need for so many service stations.

3. Have students write a story about the changes that would occur in their family lives if there were limits on the gasoline available for private cars.

4. Have students use the back of the student activity sheet to make a picture of one of the persons working at the service station.

Related Ideas

1. Set up a mock service station. Have students role-play the customer-attendant encounter at the service station. An appreciation for people who work in service roles and appropriate attitudes in such a situation should be encouraged. Use play money to give students practice in dealing with money and making change.

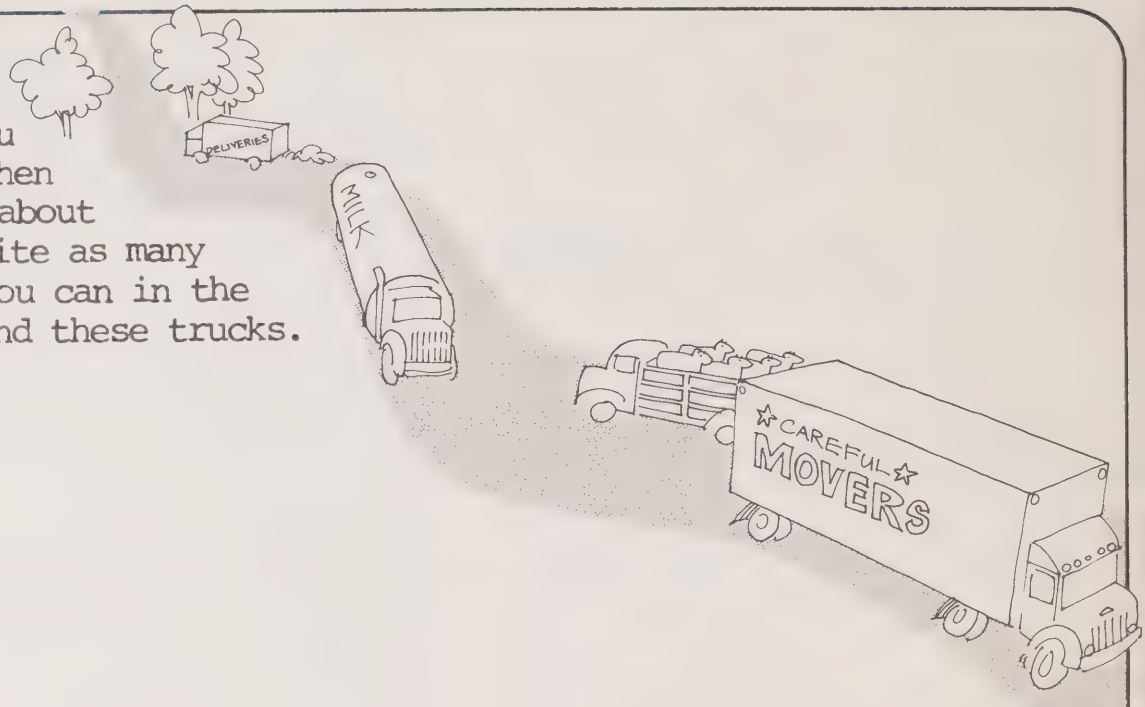
2. Have the class write a letter of thanks to the manager of the service station visited. A letter to the oil company he/she represents would also be in order. Such letters will perhaps result in the receipt of additional information or teaching aids.

3. Use the litre as the unit of measurement for gasoline to introduce liquid-measure activities appropriate to the grade level and development of the students. At the Primary level, children will probably be able to distinguish greater, lesser, or equal amounts of liquid in containers of different sizes or shapes. Concepts of quantity beyond this will likely be too difficult.

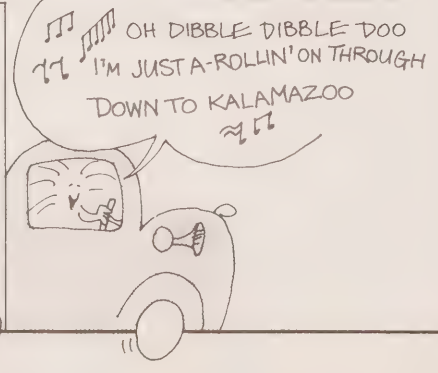
Name:

Trucking

What do you think of when you think about trucks? Write as many words as you can in the space around these trucks.



Which words tell:

what it is?	what it does?	what it has?
how it sounds?	how it moves?	who uses it?
how you feel about it?		On the back of this sheet, write a sentence that describes the work of each of the truck drivers in the picture.

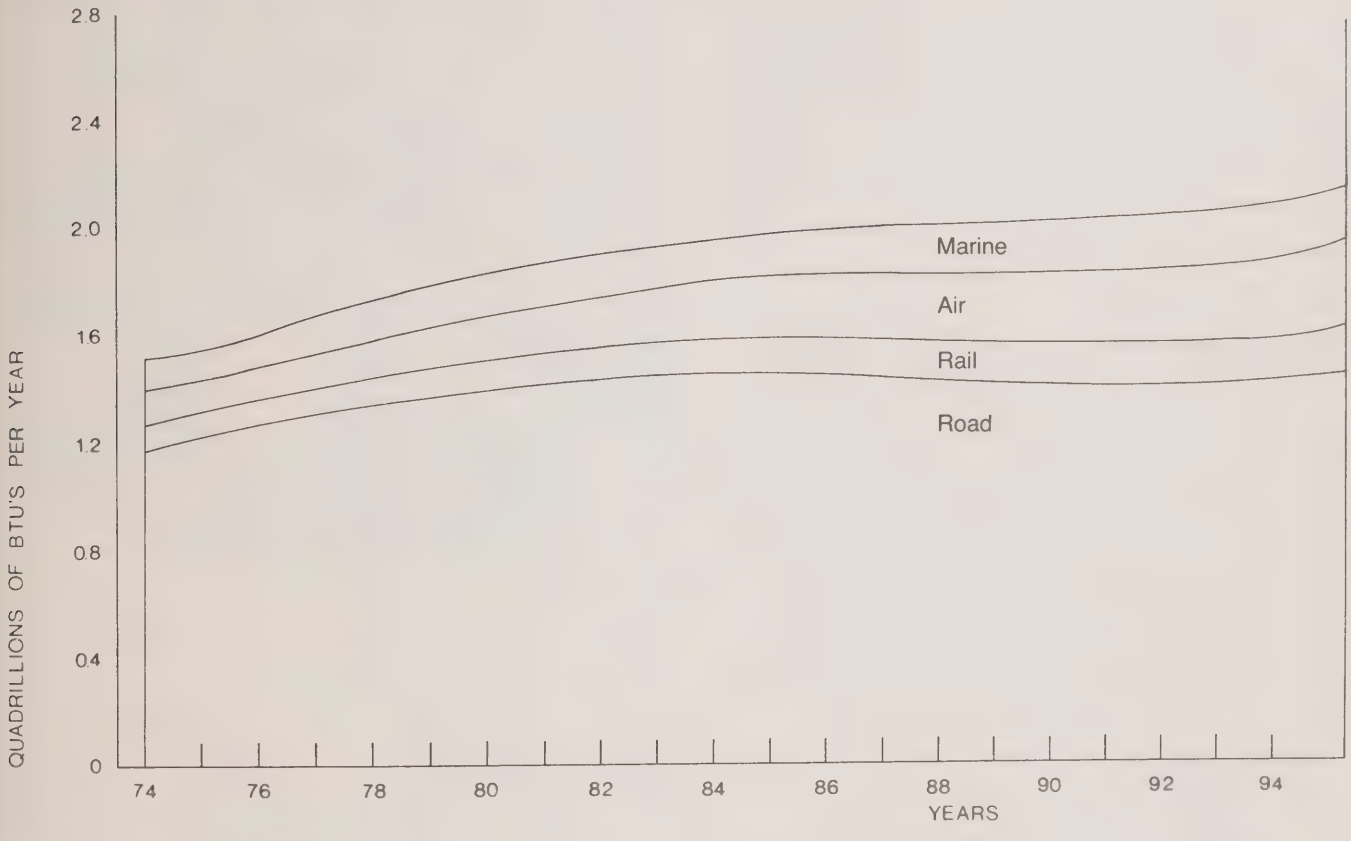
Notes

The purpose of this activity set is to describe the work of a truck driver. The children should be led to identify petroleum as a source of energy on which the trucking industry depends.

By now the children have identified a variety of transportation modes and have classified them according to whether they transport goods or people. This activity, or series of activities, develops the concept that the things we need, which are called "goods", must have a means of getting to us.

In Canada trucks probably transport more goods than does any other mode of transportation. Although some increases in other forms of transportation are forecast, road transport will continue to be dominant.

Figure P4.5: Energy Demand in the Transportation Sector



Source: National Energy Board, *Canadian Oil: Supply and Requirements* (Ottawa: National Energy Board, February 1977), p. 36. Reprinted by permission of the Minister of Supply and Services Canada.

Trucks use either motor gasoline or diesel fuel, depending on the size of the truck. (If this activity follows the trip to the service station, the words "gas", "gasoline", and "diesel fuel" should have more meaning for the children.) Since the present forecast indicates a growth in truck sales and only a moderate decrease in the fuel consumption per truck, the energy demand in this sector will continue to grow. The implications of increases in energy consumption, road construction, traffic congestion, and environmental problems are issues that should be dealt with.

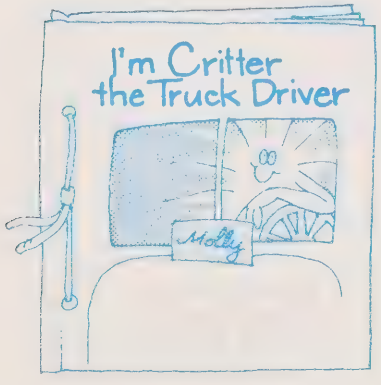
The topic of the role of trucks in providing services for our communities is easily integrated with a "community workers" study that is carried out in many Primary classrooms. The relative importance of the trucks in a time of energy crisis might be an interesting issue for a Grade 3 class to consider. Certain services that are taken for granted, and their lifestyle implications, can be discussed and questioned.

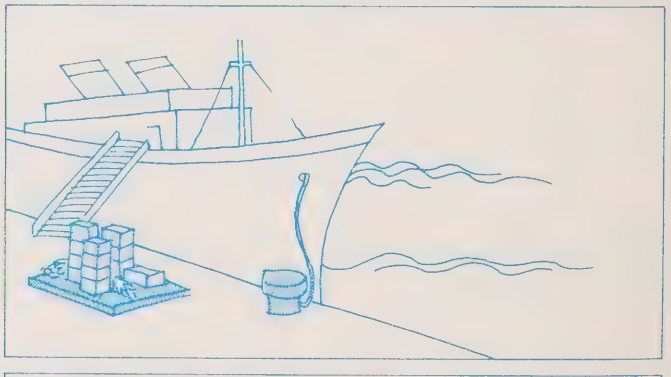
The student activity sheet can be used as an individual activity at the Grade 2 to 3 level. For younger children, the illustration can be used to stimulate responses, which you can write down. By categorizing the words suggested, the children are encouraged to organize their thoughts. In discussing "how it moves", the children should be encouraged to include the words "engine", "diesel fuel", and "gasoline", and to recognize that fuel is required to make the vehicle move. The suggestion for the back of the sheet may be altered to suit the needs and abilities of the students.

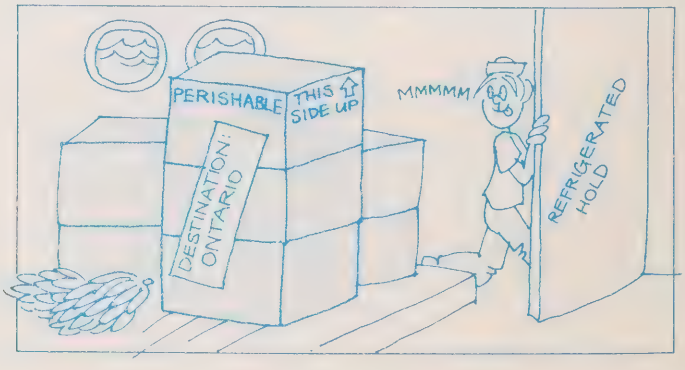
Follow-up Activities

1. Have the children construct a mural for the classroom. One possibility is to divide the class into two groups, "urban" and "rural". Begin with a discussion of the trucks or truck-like vehicles that the students are familiar with. Suggest construction and agricultural vehicles if they are not mentioned by the group. Make sure that both goods and service vehicles are included. Each child can draw and cut out a truck appropriate for a particular background (prepared either by the students or by you). The mural can then be completed by painting in buildings and appropriate scenery. Other modes of transport can also be included.

2. Have each child choose a kind of truck driver that he/she would like to be and prepare a drawing and a story (in booklet form) about this job.

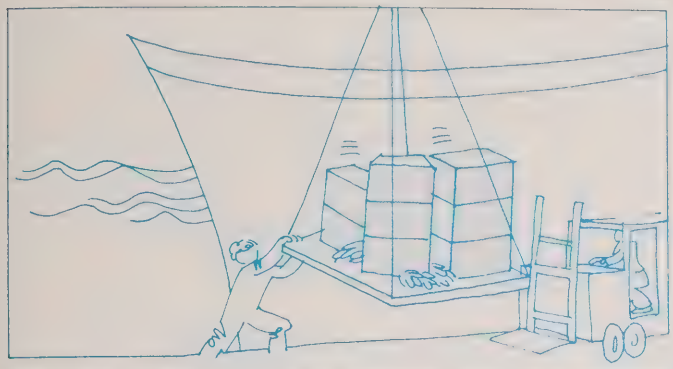


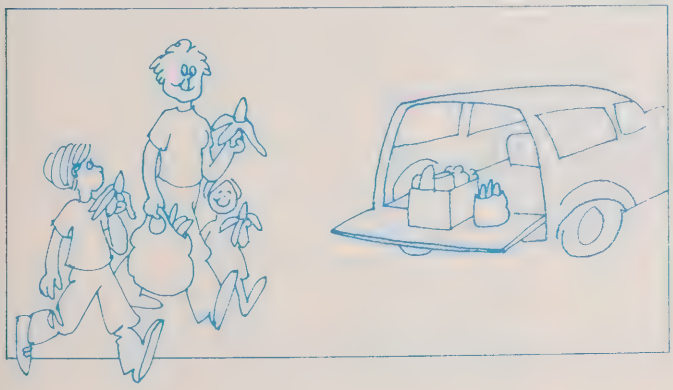




3. Ask the children what fruits they like to eat. Have them star those on the list that they think may have to travel a long way to get here. Locate the countries of origin of familiar ones (e.g., pineapple, banana, orange) on a world map.

Divide the class into small groups (four or five students in each) and ask each group to show a transportation system for goods travelling from the farm to the supermarket. Each child in the group can be responsible for one picture. The pictures can then be arranged in sequence. Encourage group discussion and the allocation of tasks by the group.





Related Ideas

1. Arrange for a class visit to a trucking depot. Have the students find out about the organization of a large trucking company. They can interview the manager, a dispatcher, a mechanic, a driver, a warehouse worker, and a secretary.

2. Plan a visit to a fire station to examine the special kinds of vehicles there.

3. Help students to set up a display of model trucks and to label each according to the goods it carries or the services it performs.

4. Have students keep a record of the trucks they see in the community over a two-week period. Prepare a class bar graph to show these types and their frequency.

5. Show films that deal with trucks.

6. Provide poems and books about trucks for the reading corner.

7. Discuss CB (citizen-band) radios with the students. Have them discuss their advantages for a truck driver. Discuss why they have become so popular and ask the children whether they can see any disadvantage to this. Allow them to tape "CB conversations" to share in small groups.

Name:

What Is It?

Examine this drawing. Turn it so that you can look at it from all directions. What does it make you think of? Add to it to create something. Name your creation.

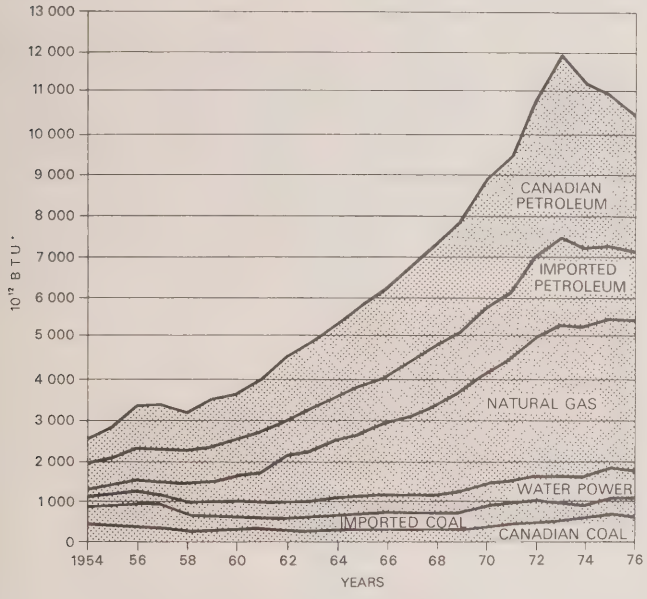
Write a story about your "thing" on the back of this sheet. What does it do? Is it alive? Where does it live? Put yourself in the story.

Notes

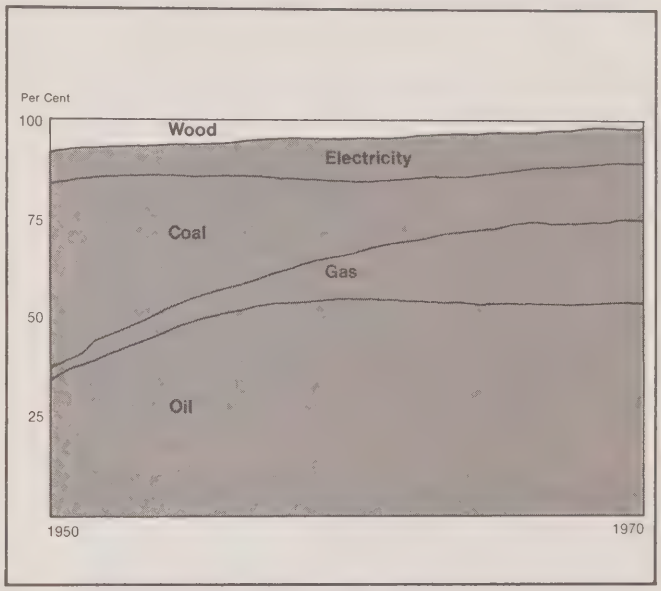
This activity is intended to help students, through the motivation of a creative experience, to identify oil as the source of energy for transportation fuels. They will also sequence the events that occur from the oil well to the production of oil products, and recognize that oil is a limited resource.

The first Canadian oil well, at a depth of only 18.28 m, was dug in Lambton County, Ontario, in 1858. This was the beginning of a search for "black gold" that was to have a profound effect on our society. Oil eventually became our major source of primary energy, as can be seen in the following graphs.

Figure P4.6: Changing Pattern of Energy Sources in Canada

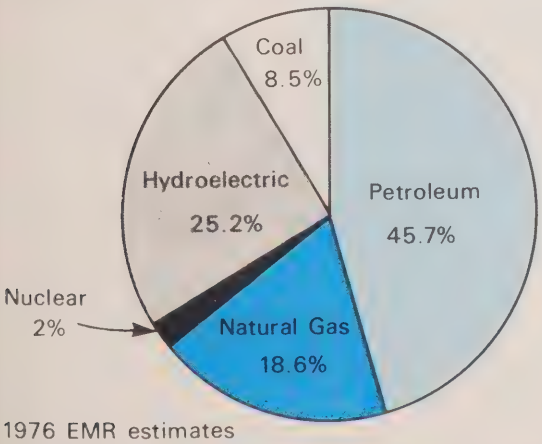


* One British Thermal Unit (B.T.U.) is the heat required to raise 1 lb of water through 1 degree Fahrenheit. It is roughly equivalent to the heat contained in one wooden match.



Source: Energy, Mines and Resources, Canada, *Introduction to Energy in Canada* (Ottawa: Publishing Centre, Supply and Services Canada, 1977), p. 1. Reprinted by permission of the Minister of Supply and Services Canada.

Figure P4.7: Sources of Primary Energy

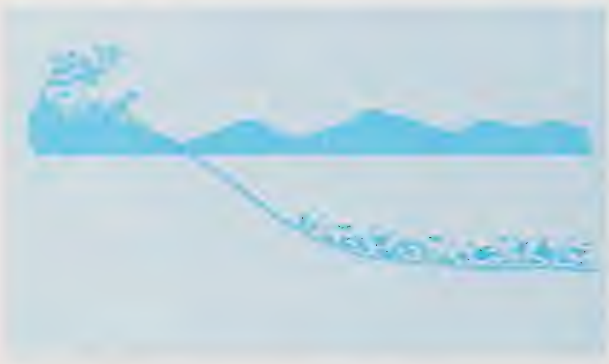


* 1976 EMR estimates

Source: Energy, Mines and Resources Canada, *Energy Update* (Ottawa: Publishing Centre, Supply and Services Canada, 1977), p. 6. Reprinted by permission of the Minister of Supply and Services Canada.

Like coal, oil is a fossil fuel. Its probable origin is shown in the following illustrations.

Many geologists believe simple forms of marine life in ancient seas were the source material for petroleum.



Sediments cover the remains of sea creatures.

Through the ages the sediments become thicker.

Pressure of sediments and other forces turn remains of sea creatures to oil and natural gas.

Source: Ontario Ministry of Natural Resources, *Oil and Gas in Ontario* (Toronto: Ministry of Natural Resources, Ontario, 1967), p. 9. Reprinted by permission.

Oil is a limited resource. The process by which it has been formed, experts tell us, has taken 600 million years and our supplies will be depleted within 200 years of its first discovery at the present rate of consumption. The implications of this are two-fold: (a) our society must become less energy-intensive and must practise real conservation; and (b) new energy sources must be explored and developed. The development of the idea of a limited resource and of personal conservation attitudes and behaviour is a realistic goal for Primary students.

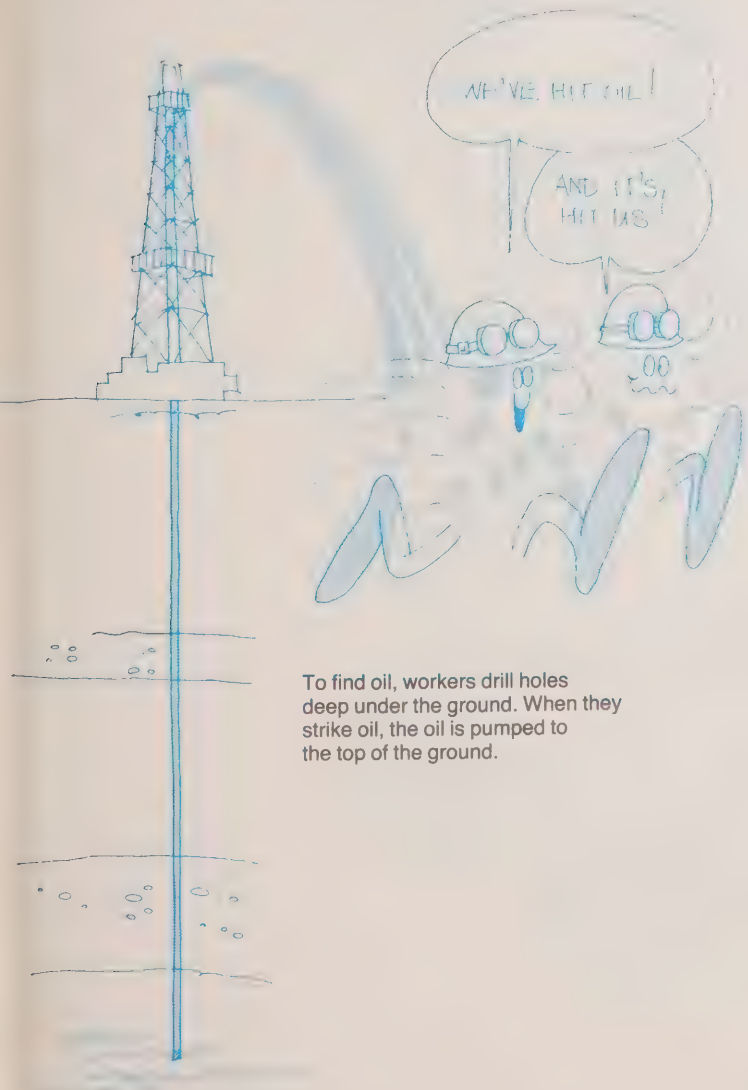
The creative activity on the student activity sheet may serve as a starting point to discuss oil. Many children will extend the diagram to create some type of creature with a devouring mouth. At this point, they can be told that the picture is actually of the bit at the end of an oil-drilling rig, which is, in a sense, "eating up" our oil reserves.

Follow-up Activities

1. Unlike coal, crude oil is not readily usable as it comes from the ground. Although the drilling and refining processes are difficult concepts for young children, they are familiar with the above-ground structure of an oil rig. A simplified version of the oil rig can be drawn on a large sheet of mural paper. Each child can then be asked to list one use for oil and its derivatives to reinforce the idea of the heavy demands made on oil. (Encourage students to include non-transportation uses of oil, such as in plastic for toys and creams for cosmetics.)

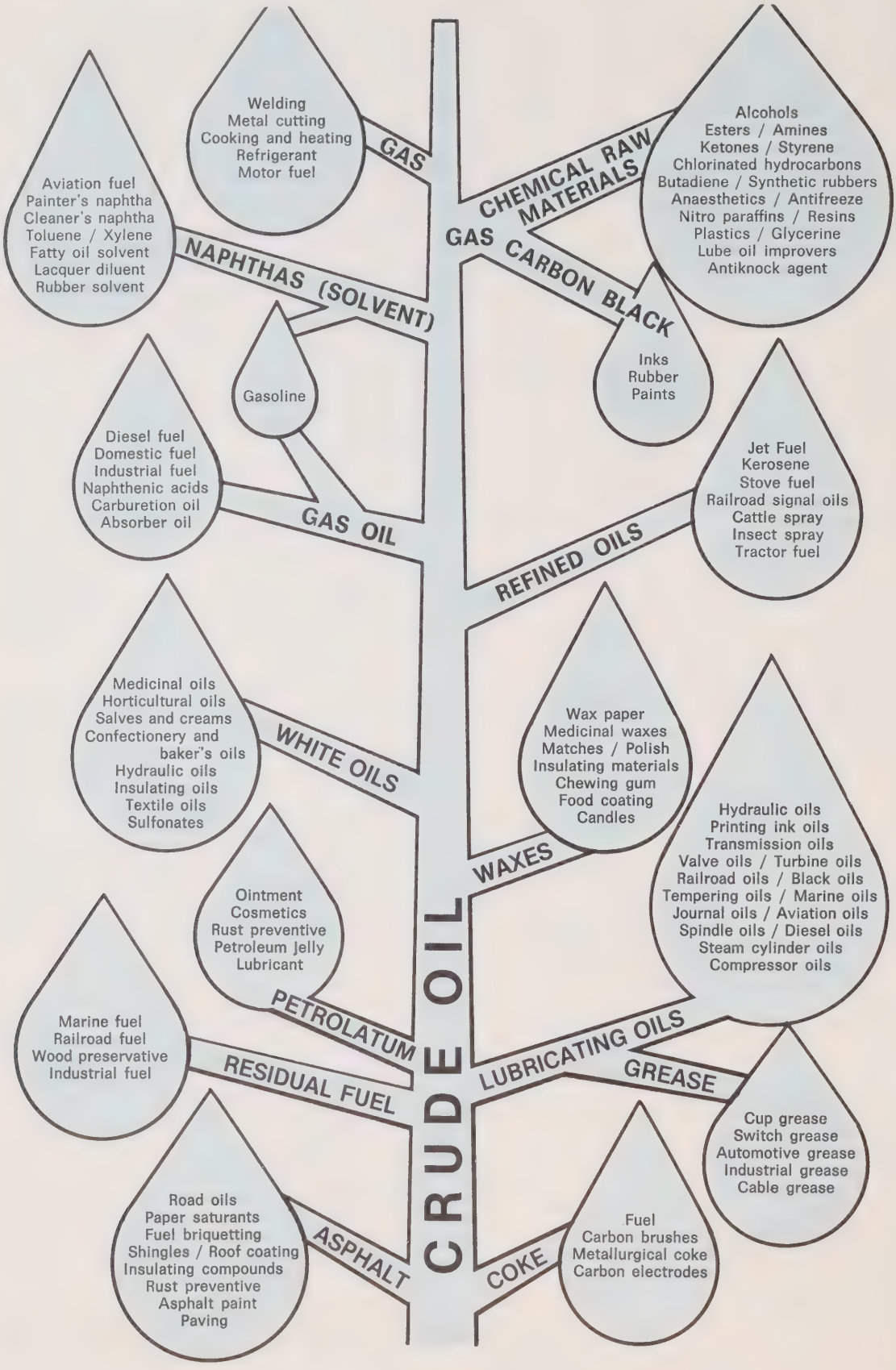
2. Play the following Conserver Society Game with the children. Provide them with a large jar of jelly beans (preferably one with a narrow neck) and a long spoon (soda-fountain type). Tell the children they may have free access to the jelly beans in the jar. Discuss with them how long the candies might last. Discourage equal rationing, but encourage them to make decisions about reasonable use. Give them only one rule: like oil, once the jelly beans are gone, they cannot be replaced. (This might be an appropriate time to draw a parallel between food as the fuel that makes our bodies work and the gasoline that fuels a car.) Keep a record of how long the jelly beans last and congratulate the children for their conservative use.

3. The children will be amazed at the number of products (actually several thousand) that can be made from crude oil through a variety of refining processes. The following diagram is for your information only. A large "tree trunk", similar to the one in this diagram, can be posted on the bulletin board. It can include large, drop-shaped "leaves" on which the children can draw (or paste magazine cutouts of) products produced from oil.



To find oil, workers drill holes deep under the ground. When they strike oil, the oil is pumped to the top of the ground.

Figure P4.8: Products of Crude Oil



Source: Ontario Ministry of Natural Resources, *Oil and Gas in Ontario* (Toronto: Ministry of Natural Resources, Ontario, 1967), p. 39. Reprinted by permission.

Related Ideas

1. Ask the children to bring to class toys made of plastic, wood, metal, and other materials. Have them compare similar toys (e.g., toy cars made from a variety of materials) and discuss cost, durability, and efficiency in order to make decisions about best value.

2. Develop a sequence story with the children entitled "From Ground to Pump". Possible statements might include:

a) To find me you must dig a big hole. Then a pump is used to pull me from the ground. I am called *crude oil.*

b) Then I go on a trip through a pipeline. Sometimes I am put on a big ship called an oil tanker. I end my trip at the *refinery.*

c) At the refinery I am changed into many products.

d) Sometimes I am made into gasoline for cars.

e) Sometimes I am made into diesel fuel for big trucks, ships, and trains.

f) Then I go on another trip by truck to where I am needed.

Cut the story into strips and have the children arrange them in the correct sequence. Complete the activity by asking them to draw an appropriate picture for each step.

3. Give the children a variety of sizes and colours of drop-shaped paper. Suggest that they give each of these "oil-drop creatures" an appropriate name and personality.

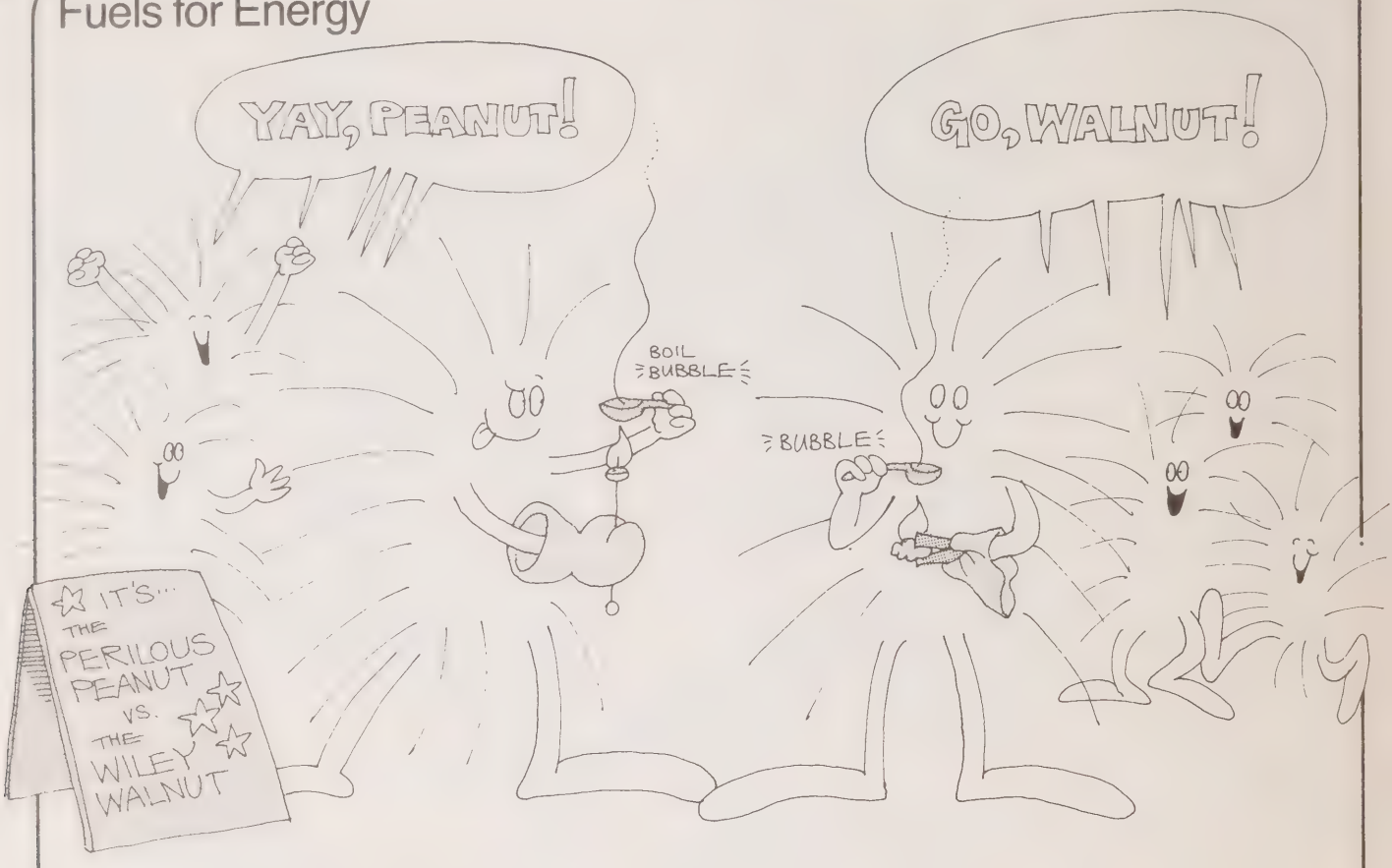
4. As a spelling activity, decorate an "oil barrel" (ice-cream or chip container) with "oil" words.

5. Find articles about an oil spill from a tanker and discuss them with the class.

6. Find articles about the Alaskan pipeline and discuss them with the class. Relate this topic to studies of Native peoples.

Name:

Fuels for Energy



Did the peanut and the walnut burn? _____

How long did each burn?

- peanut _____

- walnut _____

What was left? _____

_____

What happened to the water in the spoon? _____

_____

What was produced? _____

_____

What was left? _____

_____

Notes

In this activity set the children will identify fuels as sources of potential energy. With your direction, they can also identify and describe how some of these sources are converted to kinetic energy.

In the previous activities in this unit, the children have identified types of transportation and the energy sources associated with each. Energy that is stored and ready to use is *potential energy.* Thus, a car with a tank full of gasoline contains potential energy. The gasoline is stored and ready to make the car move. Energy that is causing work to be done involving motion is called *kinetic energy.* Thus, a moving car possesses kinetic energy. An attempt is made in this activity set to demonstrate that a fuel must be burned in order to release its energy. This activity set can be related to nutrition whereby the body uses food as the fuel necessary for it to function.

This activity is best carried out by two student demonstrators who have been briefed in the experiment; the rest of the group can act as observers and reporters. Use the illustration on the student activity sheet to explain the procedure. The handles of both the spoon and the instruments used to hold the peanut or walnut should be insulated to prevent the students from being burned. A dissection probe with a plastic or wooden handle might be best for piercing the nut and for holding it when it is set afire. Once the nut is burning, a spoon filled with water can be held above the flame until the water in it boils. You should test the activity before it is carried out by the students.

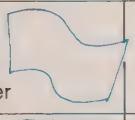
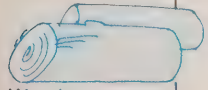
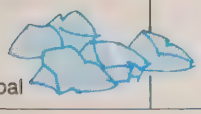
Coach the students to notice that, in burning, both heat and light are produced, along with considerable residue from the incomplete combustion. The energy released in the burning is used to heat the water in the spoon. Sufficient heat will be released to cause the water to boil.

Relate this to the burning of fuel in the operation of a car. In this case, the engine gets hot and the exhaust contains particles from the incomplete combustion.

Follow-up Activities

1. Using scrap materials, carefully burn, in a safe place, small quantities of other materials (e.g., candle, paper scraps, wood scraps, powdered coal, or charcoal). Try to select amounts of approximately equal mass. Have the children discuss the efficiency and waste products of each and then complete the following chart:

Table P4.4: Burning Materials

Material Burned	Burned Brightest	Burned Longest	Most Waste	Possible Use Today
Candle 				
Paper 				
Wood 				
Coal 				

2. Have the children conduct an air-pollution survey of your community, including both industrial and residential sources. Have them note signs of incomplete combustion. Invite representatives of local industries in to discuss the problem of pollution and what can be done about it.

Related Ideas

1. Have the children bring in bathtub toys that move through the water and investigate them in order to discover what causes each to move.

2. Present the children with a number of pictures of moving things. Include things that are moved by human energy and by animals. Ask them to sort the pictures and eliminate those that could not be moved if there were no oil, gas, or coal.

3. Ask the children to make a list of ten daily activities. If we had no oil, gas, or coal, which ones would we be unable to do? Have the children draw a picture of the activity they would miss the most.

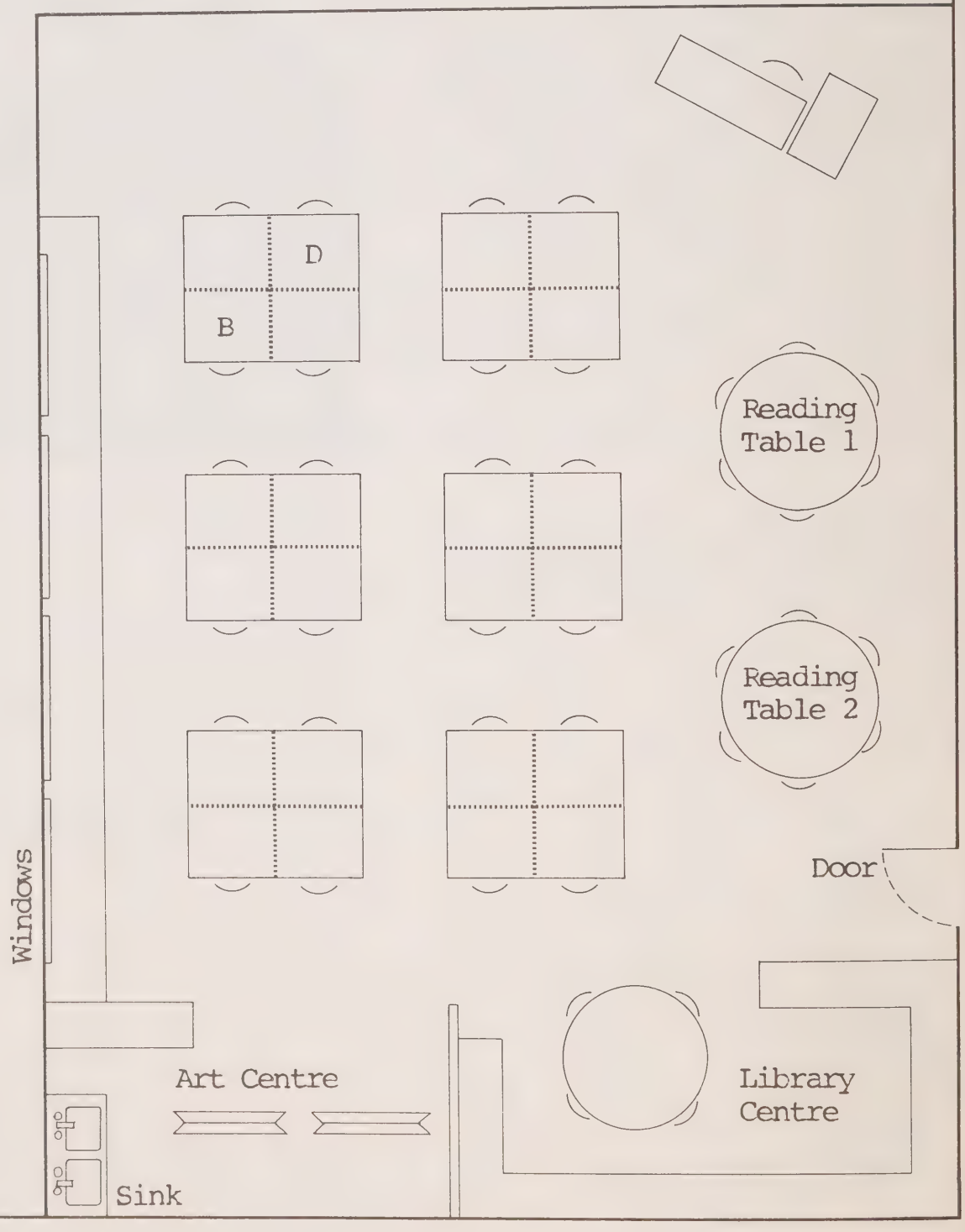
4. Ask the children to design a means of transportation for the future. It must be able to carry at least two people and cannot use oil, gas, or coal as an energy source. Have them present their models or drawings to the class with explanations of how they work.

Name:

Pathways

1. With a crayon trace the shortest path from table B to:
a) the library
b) Reading Table 2

2. Trace the shortest path from table D to:
a) the sink
b) the door



Notes

In this activity set the children will assist in the design and arrangement of a classroom that provides for efficient movement and easy access. This idea will then be extended to allow the students to identify the pathways necessary for cars, trucks, trains, boats, and airplanes.

With our ever-increasing mobility, safe and efficient pathways for transport have become an important part of the transportation system. The construction and maintenance of our highways and city streets is itself an energy-intensive activity, with asphalt demands expected to increase at an average rate of 3.7 per cent per year over the next several years.*

Highway traffic accidents are commonplace and are given extensive media coverage. Recent air-traffic accidents have indicated a need for a close look at air-traffic control as the extent of this mode of transport continues to increase. Collisions of large oil tankers have also posed serious problems, resulting not only in oil losses, but in severe pollution problems. Children are fascinated by accidents and their "news reports" reflect this. Thus, the safety factors involved in transportation might be a good focus for this activity.

The study of pathways should also be related to the activities on bicycles (refer back to Activity Set 3). Here the need for safety can be directly related to the children's own actions.

The main activity in this set is designed to allow the children to discover that organization and efficient pathways are essential to a safe, smooth flow of traffic (in this case student traffic). To make the activity more meaningful, it is suggested that you follow up the full-page activity set by using your own classroom setting as the basis for the exercise. Discuss with the children the permanent fixtures and the need for easy access to certain areas (e.g., coat storage, doorways, windows, pencil sharpeners, storage areas, fire exits).

Provide small groups (three to five students each) with large pieces of newsprint and allow them to draw up plans for the arrangement of the portable furniture in the room. Discuss their plans and actually try them out. Allow the groups to evaluate the plans after a few days and to list any problems. Discuss situations that might cause the plan to be altered (e.g., a new centre to be set up or an increase or decrease in the number of students). Set up a permanent planning committee and provide a box in which the class can put suggestions for the committee to consider.

Follow-up Activities

1. Divide the class into four groups. Provide each group with one of the following research tasks. Allow them to choose their own method of presenting their findings.

Group 1: Roads

- How are roads made?
- Who is responsible for their construction? (government)
- What are the controls on road traffic?

Group 2: Railways

- Set up a toy train system.
- What are tracks made of?
- Who is responsible for their construction? (railway companies)

(Advanced readers might enjoy reading about the construction of the railway across Canada.)

Group 3: Boats

- Do boats need pathways on lakes, rivers, and oceans?
- Why are canals built?
- Build a model or make a diagram to show how the locks on the Welland Canal operate.

Group 4: Planes

- What kind of pathways do planes need?
- Who controls the flights?
- Make a mural of an airport showing planes landing, taking off, and flying at different levels.

2. Prepare a worksheet for the students showing an industrial area, a residential area, a school, and a shopping centre. Have the students draw on the streets, including the necessary traffic signs and signals. The following illustration is a sample; however, the exercise will be more meaningful if it relates to the school community.

3. Have the students choose a transportation system that interests them and make a picture of all the people who work in the system. (For example, a railway system includes the people who construct the cars and tracks; those working on maintenance or in loading yards; travel agents and people working in a ticket agency; train operators; caterers who provide food on the train, etc.) Provide sufficient and suitable resources for locating the information.

Related Ideas

1. Provide a basic board game (e.g., "Snakes and Ladders"). Encourage the children to make up their own transportation game.

2. As an independent activity, give the students a root word and have them build a "street of words" (as in the following example) from the root.

snow	snowball	snowy
	snowing	snowman

3. Tack a railway track on the bulletin board. Write the beginning sentence of a short-story summary on an engine cutout and the ending sentence on a caboose cutout. Place the middle sentences on cars of the same size and shape for the children to sequence. Make several blank cutouts available as well, and encourage the children to write "sequence trains" for their friends to order.

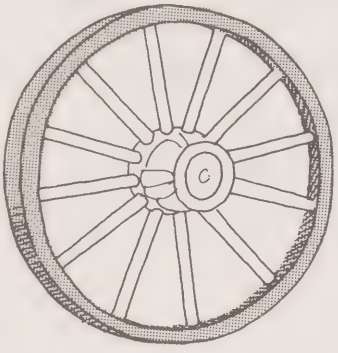
*National Energy Board, *Canadian Oil: Supply and Requirements* (Ottawa: National Energy Board, February 1977), p. 56.

Name:

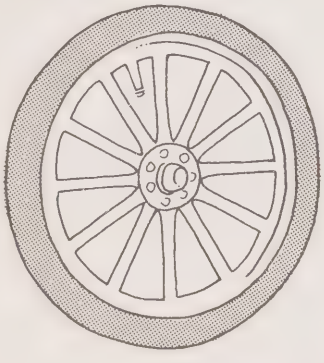
Wheels

Using these wheels as starting points, draw pictures that show methods of transportation:

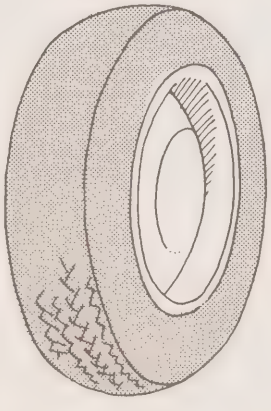
1. over 100 years ago.

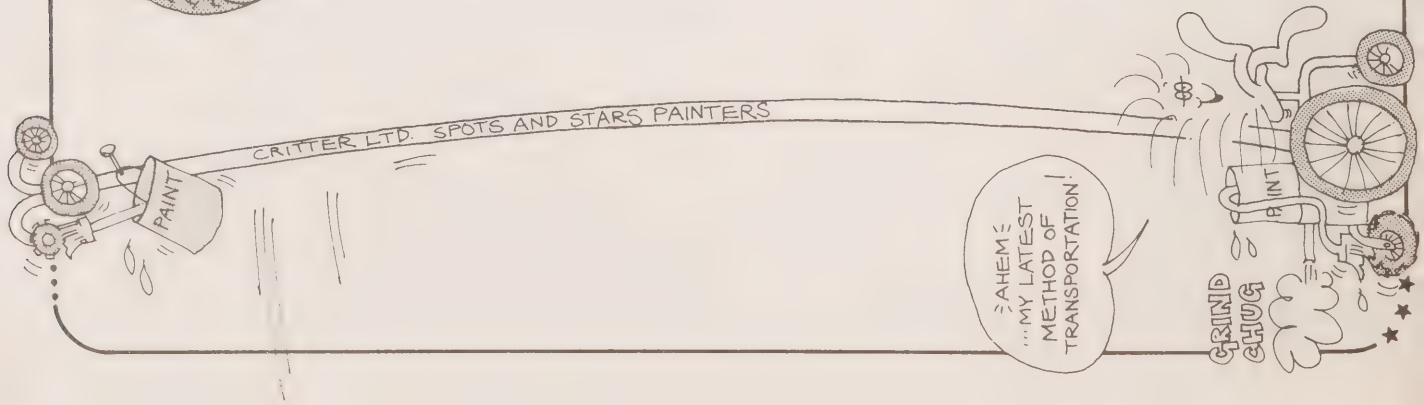


2. 50 years ago.



3. today.





Notes

The purpose of this activity set is to examine the history of transportation through the development of the wheel.

The development of transportation has had a major effect on the development of societies and the growth of communities. The first innovation in land transport was the development of the wheel over 3000 years ago. The development and refinement of the wheel, coupled with increasing power as people moved from the use of human energy to animal energy and finally to machines, gave humans the mobility necessary to extend communities and to travel and transport goods long distances over land.

The activity is best introduced by a visual presentation – either through a filmstrip, or a set of study prints that depict the history of the wheel. The children could then complete the activity sheet.

Follow-up Activities

1. Ask the children to place themselves in the time frame of each of the pictures they drew on the activity sheet and to tell where they might live and where they might be going. Ask them what their ride might have been like and have them write a sentence or short story to go with each picture.

2. Have the children build wheeled vehicles, using a variety of materials from the class "junk box" for wheels (e.g., spools, a broom handle cut in pieces with a centre hole bored to hold an axle, cardboard or plastic discs, discarded wheels from old toys). The children will probably be able to add to these suggestions. Set up a museum-type display with a description card showing the following information:

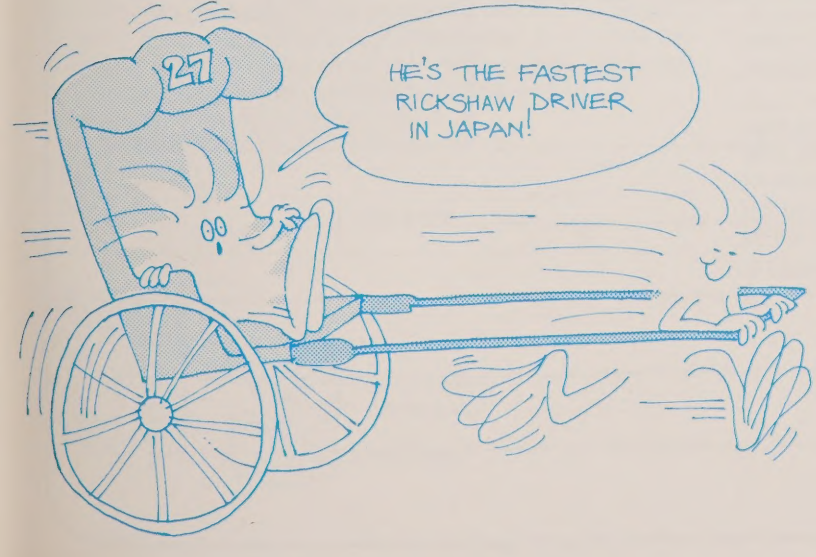
Name:

Purpose:

Energy source:

Created by:

3. Integrate this activity with a social studies unit on other countries and cultures. Have the students prepare a bulletin-board display around a map of the world. As each area or country is studied, the children can draw, in large circles, a picture of a mode of travel typical of that country, either now or at some point in its history. (Not all will have wheels.) Ensure that the children realize which vehicles are current and which are historical.



Related Ideas

1. The children might enjoy the following activities based on circles:

a) They can trace circular shapes to make creative designs. At the Grade 3 level, the children might create designs with compasses.

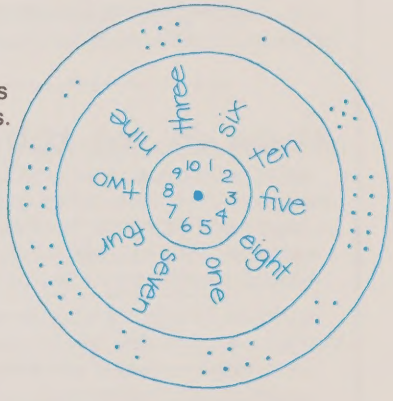
b) They can create mobiles from circles of various sizes, shapes, and materials. Discards such as fabric scraps, cellophane, foil, gift wrap, wallpaper, and cardboard from cartons can be used. The mobiles can be suspended from the ceiling using discarded coat hangers.

2. Grade 3 children will enjoy making their own trundle wheels for measurement purposes. Cut a circle of 1 m in circumference from any sturdy material. Have the children mark off the centimetres, using a tape around the outside of the circle. They then attach this circle to a piece of dowelling, so that the wheel spins like a spinning wheel. A small scrap is glued to the dowel so that it will make a clicking sound as it passes the 1 m mark. This wheel can be made by a small, interested group of students and placed in the math centre to be used for actual measurement activities.

3. A small group of students can make a spinner game for other children to use. A Grade 1 sample might contain numerals, numbers, and sets to match, as shown in the illustration. The three wheels are attached with a butterfly clip so that they can be turned easily. This device can be used to drill number facts or adapted for word-building practice.

Spinner Game

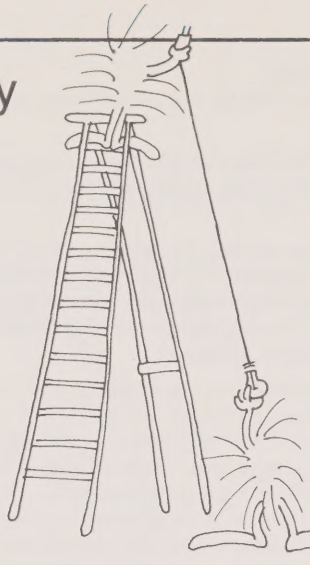
- The outer circle contains set configurations.
- The second circle contains the names for the numbers.
- The inner circle contains numerals.
- The circles are attached with a butterfly clip so that they turn.



4. Use rope loops and hoops in the gym to develop body awareness and co-ordination.

Name:

Electricity



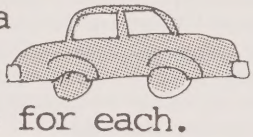
Invention

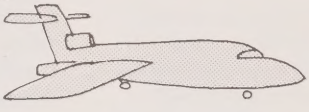
I've done it, I've done it!
Guess what I've done!
Invented a light that plugs into the sun.
The sun is bright enough,
The bulb is strong enough,
But, oh, there's only one thing wrong...

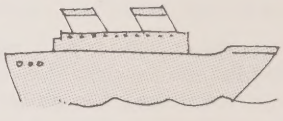
The cord ain't long enough.

Source: Shel Silverstein, Where the Sidewalk Ends (Toronto: Fitzhenry & Whiteside, 1974).

What things need electricity to work?

in a 

in a 

in a 

List two for each.

_____ _____ _____

_____ _____ _____

Where do you think this electricity comes from?

_____

_____

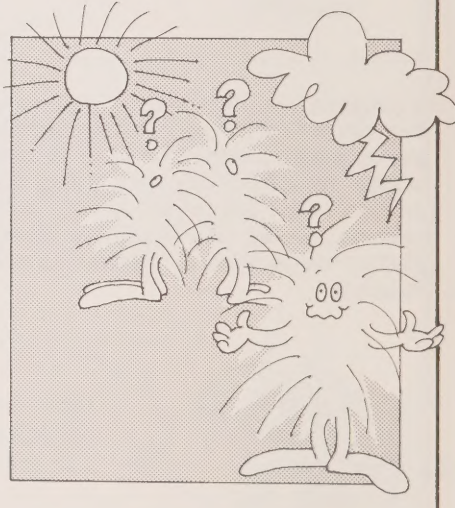
_____

_____

_____

_____

_____



_____

_____

_____

_____

Notes

In this activity, the children will identify electricity as a form of energy. They will also discover that electricity is generated by a primary source of energy and can be converted to light, heat, or motion.

Although electricity is not an obvious energy source in transportation (except for some large mass-transit subway systems), some consideration should be given to it in this unit. Large amounts of electricity are used, for example, in the manufacturing sector to produce the cars, planes, and large numbers of leisure craft on the market. Electrical energy is a temporary source of energy that must be converted to another form to be used. Today's child lives in a plug-in world, with an increasing number of traditional "plug-ins" being made portable through the use of batteries and transistors which store electrical energy.

Shel Silverstein's poem "Invention" should be read to the class and followed up by a discussion. Have the children suggest ways in which the problem could be solved. Encourage them to consider the sun as the ultimate source of energy. (Also discuss how fossil fuels, wind, and water energy are used to produce electrical energy.)

The second section of the activity sheet can be completed from the group discussion. Allow children to suggest answers to the question: "Where do you think this electricity comes from?"

Bring to class a bicycle equipped with a generator-operated light. The children will see that they must turn the pedals (use their muscle energy) to produce stored energy in the generator, which is connected by a wire to the light. When sufficient energy is generated and stored, it will travel through the wires, causing the lamp to give off light.

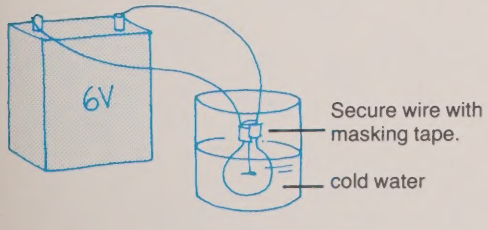
Follow-up Activities

1. Explain to the children that batteries are also used to store electrical energy. If these are connected by wires to a small lamp, the lamp will light. Provide each group of three or four students with two D-cell batteries, a flashlight lamp, and bare copper wire (about 1 m). Ask them to connect one cell to light the lamp. Have them experiment with two cells to see if there is a difference. If these materials are not readily available from a science room in the school, use flashlights that the children bring from home. Take the flashlights apart and, with the class, examine how they work.

2. Stored electricity can be converted to heat. Provide the children with a 6 V battery, a 6 V lantern lamp, insulated wire, and 15 mL of cold water. Coach two or three children to demonstrate this activity to the group. Set up the apparatus as shown in the following illustration. Before starting, warn the students that work with electricity can be dangerous and that only small amounts of it are travelling through these wires. Ensure that the students realize that home wiring carries much more electricity and that only experienced electricians should work with it.

Heat from Battery

Water Temperature	
Start °C	After 5 min °C



Record the water temperature at the beginning of the experiment and after 5 min. Elicit from the children the fact that the electricity from the battery caused both heat and light energy.

Note: You should demonstrate this experiment with very young children.

3. Ask the children to list five things at school and five things at home that are operated by batteries. Elicit from the children the fact that batteries make a device portable. Complete, with the class, a chart like the following:

Operated by Batteries

At School	At Home	What It Does
1.		
2.		
3.		
4.		
5.		

Discuss with the children the possibility of battery-driven automobiles. Draw to their attention the problem of storing sufficient energy for this purpose.

Related Ideas

1. Divide the class into groups of six to eight students each, and ask each group to create a machine, with each person in the group being one part of it. The students must depict the source of energy for this machine; in addition, each part of the machine should cause a subsequent action in the next part. Videotape the performances and replay the tape to generate discussion.

2. Have the children list the ten things that "plug in" that they most frequently use or benefit from (e.g., although they may not cook, they benefit from the stove). Ask them to number them from one to ten according to their importance to them. Have them choose at least three that they could get along without.

3. Explain to the children that some of the electricity that comes into their homes has as its source one of the primary energies we have discussed (e.g., coal, oil). They have already identified these resources as limited, so that they will now realize that when we use electricity unnecessarily or carelessly, we are wasting a resource.

A worth-while experience for the children would be to disconnect all electrical equipment in the classroom for a period of time. Discuss and list with the children all the uses of electricity in the room and have them suggest alternatives that do not require electricity. Ask the children to suppose that they had to give up some of these uses and to list their priorities.

4. Conduct a poster-making activity on the wise use of electricity.

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